THE ENGINEERING AND MINING JOURNAL.

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NOTE.—Communications relative to the editorial management should be addressed to Mr. ROTHWELL. The articles written by Mr. Raymond will be signed with a star.

CONTENTS.

EDITORIALS :
Hydraulic Mining and Agriculture..... 365
Engineers' and Geologists' Reports ... 365
A Rise in Powder 366
Antimony Ores..... 366
The Low Prices of Iron Ore 366
Manganese Bronze 366
Technical Education..... 367
The Hydraulic Mining Problem 370
Blast Furnace Hearths and In-Walls..... 371
L'Oiseau's Compressed Fuel. 372
Report of Quicksilver Mining Company for the Year Ending December 31, 1875.. 373
Selected List of Patents..... 373
Notes..... 373
STATISTICS OF COAL PRODUCTION..... 374
COAL TRADE REVIEW 374
IRON MARKET REVIEW..... 376
METALS 377
FINANCIAL :
New York Stocks 378
Philadelphia Stocks..... 378
Copper Stocks 378
Gold and Silver Stocks 378
Gas Stocks 379
Advertisements..... 379

HYDRAULIC MINING AND AGRICULTURE.

THE relations between the two great industries of mining and agriculture are not always harmonious. The operations of the miner are always attended with more or less damage to the land. Even in ordinary deep mining, the buildings, machinery, roads, dumps, drainage-waters, cavings of the surface, etc., are serious disfigurements, if not positive injuries. But the destruction effected by sluicing and hydraulic mining is far greater. In California, the conflict between the agricultural and the mining interests has brought out clearly the claims and the wrongs of each. The great deposits of hydraulic gravel occupy the region of the foot-hills, between the Sierra and the agricultural plain. For their successful exploitation, as is admitted on all hands, the hydraulic method is necessary ; and that method requires an abundance of water, and an outlet for tailings from the mining ground. To obtain the former expensive canals and flumes, and to obtain the latter still more expensive tunnels, have been constructed. The fine tailings, swept down the outlet by the stream, are finally deposited upon lower lands, which they cover mostly with barren sand. The landed proprietors whose property is thus injured can of course claim indemnification from the mining companies. Frequently, however, this right is abused by parties who acquire land at the mouth of some cañon in which hydraulic mining is likely to be prosecuted, and who subsequently demand an exorbitant price for their land, and threaten to prevent mining altogether, if it is not purchased at such a price, for the purpose of receiving tailings. Another andmore sweeping complaint is now brought forward. The land-owners allege (to use the language of the San Francisco *Stock Report*) that the constant sluicing and washing of soil down the rivers by hydraulic mining has impaired and is impairing the water-supply of the lowlands. It is reported that a compensation of $13,000,000 is sought for the damage so done in the past, and an injunction to prevent its occurrence in the future.

There is no doubt that mining was the industry which populated California and gave it commercial strength. Nor is there any doubt that the enforcement of such claims as are now put forward by the agriculturists of the State would be fatal to its chief mining industry. Nor can it be disputed that the construction of ditches required for mining has greatly facilitated irrigation for agricultural purposes in numerous parts of the State. On these and other points, we refer our readers to Mr. GARNETT'S letter in another column, and beg leave to signify our assent to his conclusions. Historical equity and public policy combine to dictate that, in this dispute, agriculture must give way.

But it is possible that some rational adjustment may be made, which shall restrict unnecessary damages, while it leaves no obstacle in the way of prudently and properly conducted mining. The *Stock Report* advocates the investigation of the matter by a Congressional commission, and suggests the names of Mr. HERMANN SCHUSSLER, Col. MENDELL, Gen. ALEXANDER, and Prof. GEORGE DAVIDSON, as persons competent to conduct the inquiry. These are excellent nominations, and the verdict of such a commission would command general respect.

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ENGINEERS' AND GEOLOGISTS' REPORTS.

IN connection with the reports of Professors SILLIMAN and BLAKE on the Emma Mine, we have alluded to the question, What is the duty of an expert, if a mine on which he has reported favorably, is subsequently sold, or offered for sale, at a price greater, in his opinion, than its value? On this point we now purpose to make a few observations, entirely outside of the special case which in this instance furnishes the occasion. The question itself is presented daily to the consulting engineer or geologist, and underlies his relation to his clients and the public.

The difficulty of it consists in the indefinite and double relation just referred to. The expert is employed by one party, and to that party he reports and is responsible. But in many cases his report is practically addressed to the public, and naturally the public also, if disappointed in the expectations founded on his opinion, seeks to hold him responsible.

The cases most frequently presented to an expert in this department of his business are of two classes. In the first place, he may be employed by the owner or vendor of a mining property to give an opinion of its probable value The property is generally undeveloped, and, while an unfavorable opinion of it may be quite positive, a favorable opinion must be, in the nature of the case, more or less conditional. The indications exposed on the ground, the economical conditions of mining, transportation, and reduction in the locality, the experience of neighboring enterprises similarly situated, and other evidence of vague and partial value, must furnish the basis of the opinion. If the employer asks that the expert shall estimate what would be a fair price for such a property in view of all conditions and risks, of course the duty of the latter is plain ; but this is rarely or never the case. What the employer usually wants is simply a description, vouched for by some respectable and competent party, with which he can get the ear of the capitalist, and make his own bargain as to price. There was a time when properties were sold without further inquiry on such vendors' reports ; but that time, we think, is practically past. Moreover, it may be that the owner of a property wants a report for his own information, to decide whether he shall spend his own money. Or, if this is not really the case, he may so pretend to the expert. As to this class of reports, it seems to us, an engineer is quite justifiable in doing, honestly and faithfully, just what he is employed to do. He is responsible for the intelligence and accuracy of his statements, but not for the conclusions that others may draw by sanguine interpretation from them. For his own protection, it is his right, and may be his duty, to protest against partial publications, leading to false impressions, of his views. But he cannot be expected to spend his time watching newspapers or prospectuses, in order to detect and expose such misrepresentations. In a word he may and should, like any other gentleman, protect his own reputation as far as practicable—though how far that is practicable, under the new code of journalism, which regards every "item" as a fact, and puts an "uncontradicted" rumor on the level of a judicial decision, it is not easy to define.

A second and equally frequent case is that of a conditional contract of sale already made, upon which the expert is called to report for the purchaser. If the price fixed in the contract is submitted for his opinion, his duty is clear, though it may be difficult. But this is notoriously not the case. In our own experience, it has occurred but a few times in hundreds of instances. Almost invariably, A has made certain representations to B concerning the property for sale, and has perhaps backed them up with a report from an expert. B has agreed to buy the property at a certain price, provided an examination by his expert shall confirm the representations. The latter is not made a party to the original bargain, and often is not informed of its terms. He is paid to investigate the question submitted to him, and no more. It may seem strange that the intending purchaser, asking advice from a competent person, should omit the vital point of *price*. Yet such is the fact, and for two principal reasons. In the first place, the price of a property turns on one condition entirely outside of its mining capacity, namely, the local rate of interest. In a region where two per cent. a month is paid on secured call loans, a mine ought to promise a hundred per cent. Even in California, where the rate of interest is not half so high, forty or fifty per cent. is the annual dividend required to support the price of a mining stock on exchange. The usual rate of dividend from metal mining (except in those rare cases in which the certain results for years are positively calculable) should be from three to five times the rate of ordinary interest. Evidently, foreign and domestic capital should be invested on the same terms. But this is not the usual practice. Mines are sold in New York or London, because investors in those places are attracted by the prospect of returns which are not in San Francisco considered sufficient to cover the risks. In the second place, the purchaser who employs an expert usually intends to sell again, or organize a stock company. Under the English system, the stock company is often already provisionally organized, and the stock provisionally sold. The "promoters" of the company do not care anything about the price to be paid for the mine. If the report is favorable, they can immediately realize large profits, and cover all their personal risks. Hence, the last thing they desire is to have a price mentioned in the report, which, if calculated (as we think it ought to be) on the basis of the local rates of interest, would inevitably be far below the price they have fixed in London or New York.

Some years ago, we stated the case of an English company in the inchoate stage, the promoters of which rejected the adverse report of an American expert, and employed a couple of English engineers, who made a favorable report, on which the mine (in Utah) was purchased, with memorably disastrous results. In another case within our knowledge, a New York *clique*, who had conditionally purchased a lot of claims in Nevada, and conditionally sold a lot of stock based upon them, denounced and threatened to sue the engineer who reported that the whole thing was a swindle, and thus destroyed their enterprise. A third case occurs to us from our own experience. During the petroleum excitement, we were employed to examine a piece of oil-territory in Pennsylvania. There were no borings on it ; and all that could be ascertained about it was that it was apparently well located, on a line of productive territory, within easy reach of transportation, and that the "sand-rock" elsewhere bearing oil would be found at a moderate depth below the surface. But the price, $40,000, seemed to us too large for a tract which, if oil were not found upon it, in paying quantities, would not be worth the hundredth part of that sum. Our opinion as to price having been desired, we stated it frankly, and our clients declined to purchase. But we were afterwards informed that the vendor, upon the statement of favorable facts made by us, sold the same property for $60,000. We cannot vouch for this, nor for the further statement that the property proved much more valuable than either sum. We have never visited

it since; but we know that its immediate neighborhood, at least, became subsequently the center of an active production. Now, in that case, it was certainly not our business to hunt up the reported purchaser of the property, and tell him that in our opinion he was paying too much for it. What he might be willing to pay for a speculative risk was wholly his own business. Our responsibility ended with our statement of the facts.

Now, what shall the expert do, in such cases as we have sketched? We do not see how any fixed rule can be laid down. Principles may be stated; but rules of universal application can scarcely be framed. Some engineers decline to report for vendors, or to make any reports in which they are not allowed to state their opinion of the proper price of the property. This is very convenient for them—if they can command enough business of a different sort. Some protect themselves by studiously making their reports non-committal, or by underrating, so far as possible, the value of the properties they examine. This habit gets found out in time, and though it is far better than the habit of sanguine exaggeration, it is a poor substitute for that thorough inquiry and frank statement of results which justice demands. In fact, it is the cheap resource of incompetence and timidity. Some make measurements, tests and estimates of working capital, cost and profit, leaving it entirely to their clients to decide how much money may fairly be expended in the purchase. This, it seems to us, is perfectly legitimate; but the instances are numerous, in which, the property being undeveloped, its price is a matter of speculation, and not subject to estimates. All mining experts, so far as we know, generally avoid giving an opinion on the matter of title. This is often, in the Far West, a great pity. The engineer would, in many cases, be able to give hints, at least, on that point, which might save his clients much subsequent trouble.

Beyond all doubt, an expert should avoid vague generalities which can be misunderstood or misused. A man who talks about the "immense" or "inexhaustible" resources of a mine is simply signing a blank certificate, which others may fill out with as many millions as they choose to name. It is equally plain that he should not suppress any unfavorable indications or conditions, the knowledge of which is essential to a fair judgment. *His wisest and safest course is to state fully all the facts on which his own opinion is based*, so that a competent reader of his report may form, to some extent, an independent conclusion. Moreover, there should be no pretense of an ability to decide questions which are in their nature insoluble, or which the reporter himself is not competent to discuss. As to the speculative operations which may be based upon a report, the author is not bound to make public protest, unless his authority is dishonestly employed to bolster up a swindling scheme. *Then*, nothing in his relations to his clients can forbid him to set himself right with the public, by disavowing the statements made in his name, or insisting upon the full publication of what he has written.

The best way is to have such matters frankly understood or put in writing between the expert and his client before the commission is accepted. Cases of casuistry, in honor as in religion, are better avoided than argued. ✲

A RISE IN POWDER.

A STRIKING example of the effect of a combination among manufacturers for a rise in their product was reported by telegraph from Salt Lake City on the 5th inst. For some time past there has been an over-production of blasting powder, as well as of iron and silver, and the price has declined to a very low point. In market phrase, powder has been "dull, drooping, and greatly depressed," for some time. To relieve this monotony, a combination of the various companies was effected at Salt Lake City, on the 5th inst., and as a consequence, powder went up suddenly to an unprecedented height—and, unfortunately, there is no probability of its again falling. The quantity disposed of by this combined effort was some 35 or 36 tons, and the effect of the rapid advance was felt throughout the city and vicinity, causing the liveliest apprehension to consumers and dealers generally.

The bears who opposed this sudden inflation were simply annihilated, and even those who favored an advance in price were completely carried away by the strength and suddenness of the upward movement. The strangest part of the story is, that although this combination for a rise was eminently successful, it is hinted that the companies who united in it are not yet satisfied; and now that the mischief is done, would like to bring back their powder to about its former position.

As the public generally is much excited, not to say exasperated, by the event, and even threatens to pass such a law as will effectually prevent any repetition of this demoralizing movement, the companies have found it convenient to disavow any intention or desire on their part to send powder up in this manner, and they lay the entire blame for the combination and the movement on the local agents. Whether this late repentance of the companies be due to popular indignation, to jealousy of each other, or to the twitchings of conscience (if we can imagine a company to possess any), we are unable to say, but it is now all but certain that they claim to be, individually and collectively, opposed to any recurrence of this violent manner of relieving the market; and, from a somewhat intimate acquaintance with the trade and with the views of the large powder companies, we are inclined to think they are sincere in this assertion.

It is but fair to say there is another version of this affair. It will be found among the "Notes" on another page.

ANTIMONY ORES.

OFFICE OF THE UNION CONSOLIDATED MINING COMPANY OF TENNESSEE,
DUCKTOWN, POLK COUNTY, Tennessee, April 5, 1876.

TO THE EDITOR: SIR—In the ENGINEERING AND MINING JOURNAL, of the 1st inst., I note your remarks on antimony ores, in answer to a correspondent from Little Rock, Ark. Permit me to make some corrections to your statements. The consumption of antimony (star regulus) in the United States is estimated to be about 600 tons per annum. A production of five tons per diem would certainly overstock the American market, but could be easily sold in England, which country derives its supply from mines on the Island of Borneo.

The deposit of antimony ore (stibnite) at Battle Mountain is owned by parties who have twice signally failed in smelting the ores; and to this fact and the large cost of fuel and transportation, the non-success of these mines is attributable.

In answer to your correspondent, I would refer him to a back number of the year 1873, of the JOURNAL, in which the writer described the process of antimony smelting, as carried on at the Lake George Antimony Company's Works, in New Brunswick, Canada. The cost of smelting works to produce three tons regulus daily will not exceed $20,000. Truly yours,

ARTHUR T. WENDT, E. M., C. E.

THE LOW PRICES OF IRON ORE.

THE following letter refers to a subject of great interest in more than one mining district. We know that the present prices of ore are unremunerative to many of our mines, and we regret the fact; but we can see little prospect of better prices in the near future. The tendency of the price of iron is downwards rather than upwards, and the prospect, for some years to come, is very distinctly for low prices; it is therefore scarcely to be expected that prices of ores will advance much. Our correspondent's difficulty is one which must rather be solved by lower cost of production than by higher selling prices, and the adoption of labor-saving appliances at the mines will probably be the true remedy:

TO THE EDITOR: SIR—I read in your valuable paper, of April 1, an article on "Labor-saving Appliances at our Ore Mines." In it you say, "There is not much doubt but that many of our ore mines have lost money during the last year, and at the same time impoverished their property." That is just the condition of the Hematite Ore Mines in Dutchess County. Those who made contracts at the low prices of the past two years have found, by sad experience, that it is not getting a "new dollar for an old one." They would have been far better off to-day if they had not mined a pound of ore at the prices paid for it since the "panic." Our ores should command a better price, for they are essential to the making of *good* iron, that sells at a good price in market. The producers have made a mistake in selling ores lower than they could mine them, after taking out those near the top or surface, not realizing the fact that the deeper they get the more it costs to raise the ore. They now find themselves in this condition: *they must get better prices or close up entirely.* L.

AMENIA, N. Y., April 10, 1876.

MANGANESE BRONZE.

MR. P. M. PARSONS, well known in connection with the conversion of cast-iron guns into rifled ordnance, as well as for the peculiar metal, which, under the name of "white brass," is very largely employed for bearings and other purposes, has recently produced an alloy, which promises to play an important part as a constructive material.

This alloy, called manganese bronze, is formed by incorporating manganese with the various bronze mixtures, with the object of removing any oxide existing in the metal, by means of the strong affinity of manganese for oxygen. The action of the manganese in the alloy is strikingly visible in the texture of the metal, a fracture of which so far from presenting the coarse granular appearance characteristic of ordinary bronze, is as closely and finely grained as the best qualities of steel, while the strength and tenacity of the alloy is greatly increased, as has been shown by a series of tests lately carried out at the Royal Gun Factory, Woolwich.

Another singular and valuable quality which this metal possesses is the facility with which it may be forged at red heat, these operations greatly increasing its strength and toughness.

The qualities of the metal were tested by six specimens, three of which were cast and the other three forged, the series representing three different degrees of hardness. These samples were proved to ascertain the tensile strength, elastic limits, and ultimate elongation, and the following results were obtained:

1. A cast specimen of tough quality adapted especially for constructive purposes, showed an ultimate strength of 24·3 tons per square inch, with an elastic limit of 14 tons, and an elongation of 8·75 per cent.

2. The same quality forged had an ultimate resistance of 29 tons per square inch, an elastic limit of 12 tons, and an elongation of 31·8 per cent.

3. This was a cast sample of harder quality. It broke under a load of 22·1 tons per square inch, had an elastic limit of 14 tons, and an elongation of 5·5 per cent.

4. The ultimate strength of the same quality when forged, rose to 28·8 tons per inch, the elastic limit was reached at 13·2 tons, and the elongation was 35·3 per cent.

5. This sample was still harder. The cast test piece broke at 23·6 tons, with an elastic limit of 16·8 tons, and an elongation of 3·8 per cent.

6. The same quality forged, had an ultimate strength of 30·3 tons per inch, the elastic limit being reached at 12 tons, and the elongation being 20·75 per cent.

From these truly remarkable results it will be seen that the first sample showed an ultimate strength equal to good wrought iron, while it is greatly superior to the best gun-metal, for which 16 tons per square inch, with an elastic limit of 7 tons, are extremely high strengths. The effect of forging this metal is also very striking, raising, as it does, the strength to such high limits, and practically giving a new and most valuable metal to the world.

In some respects, indeed, it resembles aluminum bronze, but its resistance greatly exceeds that of this alloy, which does not exceed 22.6 tons per square inch, while its elongation and elasticity are considerably inferior to that of the manganese bronze.

It would be superfluous to indicate the wide field of usefulness in which this metal may be applied. Manganese bronze, by virtue of greater strength and more reliable character, will find an application wherever gun-metal is employed, while the facility with which it can be forged, and the benefit it derives from this operation, will render it still more useful as a constructive material.—*Engineering.*

TECHNICAL EDUCATION.

Discussion on President Holley's Address.

Prof. T. Egleston.—The subject of the President's address is one of very great importance to the profession. There is, as is evident to all, a want of concord between the school men and the manufacturers, but the want is all on the part of the manufacturers. The President has shown us where the knot is, but has not cut it himself nor helped us to cut it. The unwillingness of some manufacturers to allow the student or professional man facilities, not for seeing the secrets of the trade, but the every-day manipulation, amounts sometimes to almost an obstruction to education. It is certain that this unwillingness arises in most cases, either from misapprehension of the object, or from want of tact on the part of the student. It may arise, also, from a well grounded fear that the information asked for is to be used for direct competition, in which case it is well founded, and an act of self-protection. There are those, however, who are always willing to afford opportunity and facility for acquiring knowledge, to the student, and who do not acknowledge, either in word or deed, that any antagonism exists. To their kindness and consideration, many of us are greatly indebted for substantial aid in solving some of the difficult problems. Some generous-minded men carry the desire to aid further than is wise. We, of the schools, send students to the works to acquire knowledge which will be of use to them in solving problems given them to call both their knowledge and judgment into play, not to acquire *information* which is acquired to-day and forgotten to-morrow. Some of our friends furnish schedules, complete estimates, and lists of prices, in the most friendly manner, thinking to do a service. The result is, that the ease with which the information is acquired, leads the indolent, indifferent man to copy them verbatim, without any attempt at the very exercise of judgment, which is our principal object. The incipient engineer must decline to use such information, as his conditions are not the same; but the temptation to consider such a division of labor as legitimate, is, nevertheless, very strong. What was intended as a kindness is often no help to the investigating student, and a weight which helps to drag down the man who is willing to copy; such co-operation is not what is needed, and is no real kindness. When the School of Mines in New York was first started, it was stated, that for students who wishedit, application would be made for permission to work in mining and metallurgical establishments as the highest reward of engineering scholarship which the faculty could offer; but we were soon obliged to withdraw the promise, since the manufacturers would not grant the permission. Yet it is easily to be seen that out of such men, working for a given time without wages, the manufacturer might make, if he would, men of a high order of engineering ability. The difficulty is to make the manufacturer see that it is for his interest to have men trained to think and then to see. The day I graduated from college I left the machine shop in which I had been working, to take my diploma, and went back again to the shop, and after nearly a year's work went to a technical school. For the first year and a half that I was in the profession, though in charge of very large mines, not a single important question, involving mining, arose, but there were constant questions of pumps, engines, etc., and I was led at first to think little of my technical education until it became evident that the power to use the knowledge gained in the machine shop was the result of the technical training. It is plain to any one who gives the matter a moment's thought, that no amount of learning, which can be acquired in a technical school, can give the eye-education acquired by long practice in the works, and which makes every good workman an artist. A thorough education will, however, enable one to learn the nice distinctions, which are the basis of a correct judgment, in a comparatively short time. It seems to me very doubtful whether the ability to do the manual work is desirable in the engineer. The school man must have experience, just as the ordinary workman, but he acquires it in a much shorter time. Success in this, as in other things, is more or less the record of failures. As a general thing, the man who has never failed has never tried. The failures of the ordinary workman, looking over long periods of years before they become skilled, are not noticed or forgotten, but the failures of the school men are more prominent, because so much, that is not fairly reasonable, is expected of them. It is evident that the young engineer must suppliment his education at the school by training at the works, and if his failures in properly-directed efforts are compared with those resulting from the efforts of men who have not studied abstract science, it is certain that they will be found the least expensive. What the President has laid out as a practical course means that men would not get into their profession until they were thirty years of age, which, in a certain point of view, is an advantage, but could not be carried into effect in this country, where men must begin to earn their own living about the time they are twenty-one. What is needed is to increase the requirements and advance the age of admission to our technical schools, and then to overcome the antagonism of the manufacturers, and induce them to allow the graduates to continue their study with them until they could learn enough of the professional work they must do, to feel and hear, almost by instinct, as the President has so forcibly said, what they were to do. Such a system would soon train a class of engineers not to be had now. It is easy for the schools to give men the theory, but where are they to get the practice, if the manufacturer, miner and metallurgist is to stand by them and say—yes, you ought to swim, you must swim, but we cannot by any means allow you to go into the water until you have learned how to swim.

Mr. Jos. D. Weeks.—I cannot agree with the last speaker, that there is always this want of concord, this disinclination on the part of manufacturers to allow scientific investigations to be made at their works, or if such a want or disinclination does exist, that it is entirely on the part of the manufacturers, or without reason. So far as my experience has gone, I have found the iron manufacturers of my own city, Pittsburgh, very ready to grant facilities for investigation, and work in perfect harmony with me in making experiments. At the works of Messrs. Rogers & Burchfield I spent many days experimenting on the use of natural gas in the puddling furnace, being at liberty to make any change in furnaces or their working I chose. At Messrs. Spang, Chalfant & Co., so far as I am aware, there has been every facility granted. But a week ago two gentlemen connected with the State Geological Survey were at these works making some very thorough experiments, and I know that a young gentleman, a graduate of the Professor's own school (the School of Mines), has been at these works for weeks.

Prof. R. W. Raymond thought the question of furnishing information to visiting students was chiefly one of courtesy and of present policy, while the question of giving a practical knowledge to students, or those who were to become such, was a much deeper one, bearing upon all the future. He thought that in many cases the questions asked of managers by students who called upon them were of a kind to embarrass one party without really benefitting the other. With regard to the suggestion of the President, that there are many considerations of practice which cannot be formulated, Mr. Raymond thought a large part of this imagined inability would disappear when greater culture was introduced among practitioners. A mind trained to think and to express thought would deal promptly with many of the customs and rules of practice, discarding one-half as superstitions or survivals from necessities now obsolete —like the rudimentary organs of Darwinism—and classifying, explaining and formulating the rest. The speaker did not believe much in rules or practices which could not be formulated. The trouble was the inability or disinclination of practitioners to state the facts. The President's recommendations would abate this evil. With regard to the combination of technical instruction with practice, perhaps the *Steigerschulen*, of Germany, are a good example. They have furnished some excellent mining engineers and metallurgists. He thought the introduction of a preliminary course of practical training before the scholastic training would be a great benefit to the schools themselves. It would weed out the hopelessly stupid, or lazy, or otherwise unfitted, and bring to the schools a class of young men who already knew what they wanted and really wanted it. The great difficulty with the schools to-day was to recommend themselves to the public—to parents. This could be done by the original investigations and publications of the professors, and still more by the practical achievements and business success of the graduates. Anything which tended to increase the chances of graduates to obtain opportunity of advancement, and to acquit themselves creditably therein, would benefit the schools. On the part of parents, the trouble is that they are in too great a hurry, and it is imperative that we should prove to them that a more thorough and prolonged training *pays*. Too many educators are at present engaged in the ridiculous attempt to adopt from the German system of university education everything *except the time it takes*. We keep on taking out a little more classics, and pushing in a little more science in our curricula of education, leaving the whole thing to be crammed in the same space as before. The speaker thought the only solution was to give more time, and most heartily agreed with the President that lack of general culture—of the knack of study, the power of statement, the sense of order and logic—was one of the greatest defects and drawbacks to the engineer. No illiterate man (using the term in a broader sense than that of inability to read and write) could become a distinguished engineer: or, at least, the most able engineer, if deficient in the culture which gives men power over their fellows, would be the first to recognize the lack, and lament the cause that had so crippled his usefulness and stopped him almost at the summit of that fame which could be completely climbed only by complete men. One of the members of the Institute, a gentleman of high reputation as a manager of mines and works, had recently said to the speaker that he had concluded, after much observation, that a regular collegiate education was the best preparation for a technical one, and that the time so spent was well spent, and showed its benefit surely at the other end of the student's career.

Mr. E. C. Pechin.—All are agreed as to the desirability of closing the gap between theory and practice, and the future will, undoubtedly, develop the plan by which this can be accomplished; but the important present consideration is, if we cannot close the gap, may we not make it narrower. The plan suggested by President Holley is an admirable one, all will admit, but its development will necessarily be slow, because so radical. There ought, however, to be no real difficulty in the way of graduates of the schools becoming thoroughly versed in all matters of practice. There is an apparent obstacle, in the reluctance of the graduate to accept the prospect of a year or two of real hard work. I have had a number of applications from educated and competent young men, for positions, but in a majority of cases they wanted a good salary to begin with, and the nature of their duties must be rather genteel than otherwise. What they should say is, "I have had a thorough technical education, but I want a position for a year or two, where I can become thoroughly familiarized with practice. I only ask such compensation as will reasonably support me, and to labor for a given time in the various departments of your business."

There are very few masters who would not recognize the merit of such an application, and gladly assist so laudable a desire.

Several years ago, I accepted the services of a young gentleman, who had just finished a thorough course in the German schools. First acquainting himself with the nature of our materials, he then practically became a workingman. Whenever and wherever his services were required, he offered them, day or night, in the stock-house, or at the front. He carefully noted difficulties as they presented themselves in practice, and how they were met. The result was, that in one to two years he had mastered his business in both its aspects, and he is now, though still quite a young man, in my opinion, one of the foremost furnacemen in this country. Now, this would be my plan for making scientific practicians.

If our graduates would only cultivate that very un-American characteristic, *patience*—learn to labor and wait—their success would come sooner, and be more assured. The man who learns the art of managing men, and to this adds a knowledge of chemistry and metallurgy, may become a giant, but with all possible learning, and wanting the ability to handle labor, which can only come by the knowledge of what is required of labor, he cannot hope for any large success.

This plan embraces another important point. Laboring men, as a class, are suspicious and unsympathetic, so far as their employer is concerned. By having associated with them, one becomes acquainted with their peculiarities—appreciates the difficulties they encounter—learns how to gain their good will, and this once gained, is enduring; and when the time comes for him to control, his power is well nigh absolute, for he has learned when to watch, or relax—when to exact or indulge, when to be liberal or when unsparing. His knowledge obtained from books and in the schools, tell him what *ought* to be done—his practical experience shows him *how* it can be done, efficiently and economically.

Prof. R. H. Thurston.—I listened to the opening address of our President last evening with very great interest, and should have liked to have taken an opportunity, to indorse the general accuracy, and practical promise of his views, and his plan of securing a more complete and thorough technical education and training last night, but that I presumed that an hour would be set apart, for the consideration of the more novel and more important of the propositions, which were then made. I have been asked to open the discussion this morning, and have gladly promised to do so.

I know of no subject which has more direct bearing upon the prosperity of the profession than this, and there is certainly not one, which has a greater interest for me, personally.

As a mechanic and a practitioner, I recognize the correctness of much that has been said of the "schoolmen." As one who has been accused—but I am

afraid, unjustly—of being one of those schoolmen, I agree in what was said of the so-called "practical men." Undoubtedly, both classes can do more to make our methods of technical education, and subsequent training, satisfactorily effective. Each must, however, help the other, and the best work will be done when they work earnestly, persistently, and patiently, hand in hand, with a common and well understood aim, and by well-settled plans, each helping the ther by every means that thought, observation, and experience can suggest.

The questions how, when, and where the requisite combination of theoretical and empirical knowledge of the principles of professional practice, and the experience needed to make that knowledge most readily and fully available, are to be obtained by the aspirant, have been present in the minds of all thinking members of the profession, from the time of that great engineer, the Marquis of Worcester, who, two hundred years ago, proposed the establishment of echnical schools.

It has appeared to me, that we may pursue either of three distinct courses, in the attempt to effect this generally admitted essential combination. I say generally admitted, because there are members of acknowledged high standing in the profession, who assert that, however desirable in itself the education of the schools may be, no man can afford to give the necessary time to its acquisition. I am told by a friend, for whose views I have great respect—a gentleman who is justly distinguished as an engineer—that no man can attain full success in business, who has not gone into the business at so early a period in his life, that it is physically impossible to preface that entrance upon his life-work, by more than the rudiments of a common-school education. He insisted that only the man who began his actual practice of the profession, at an age at which his powers of observation and his ability to acquire by memorizing and by tactual experience are most fully available, can succeed.

While acknowledging that these views have much truth underlying them, I presume that very few would agree to the final deduction made from them. We may find a great difference of opinion, as to how much time the young man can spare to the pursuit of scientific professional knowledge, but, we shall rarely find an advocate of its complete abnegation. The question to be discussed here, is certainly not, whether the young engineer shall have a technical training, but, whether he shall secure it in one or another, of several proposed methods. We are not asked, whether he shall have such an education and training, but, how shall we give it, and when should he seek it, and where.

I have said, that I would specify three courses, either of which may, perhaps, accomplish the desired result. These are:

First: That method which is most usually adopted, in which the student is given his education, and is then sent into business.

Secondly: That which gives the boy a common-school education, then sends him into the office, or the field, or the workshop, to acquire a certain amount of practical experience, business knowledge, and general development, and finally places him in the technical school, to obtain the professional education and scientific basis for a sound reputation, which can there be best, and most readily given him.

Thirdly: The course which, although usually most difficult to pursue, is, it I may judge from observation and experience with a considerable number of instances, the most perfectly and economically successful. That is, a mixed course of study and practice, extending throughout the early life of the man, up to his final and complete immersion in the practice of his profession.

It is possible that I may be influenced by that prejudice, which most men have in favor of a course, which has answered its purpose, more or less fully in their own cases, or in cases which have appeared to them illustrations of great, or of even moderate success; but I believe that the boy who, with natural predisposition toward a certain branch of engineering, spends his weekly holidays, and his vacations playing about the workshop, growing up in contact with the workmen, and witnessing continually all those operations which, as he becomes old enough, he learns to conduct himself, imbibing, with that wonderful accuracy and rapidity for which boys are remarkable, all the traditions and recognized principles of shop practice, learning the construction and use of tools, and now and then acquiring the art of manipulating a machine or handling a tool, I believe that this boy will most easily and perfectly secure the technics of his profession.*

The course adopted generally in this and in all countries, is the first of those specified. The boy is sent to school, and is given the usual common school education. Upon concluding this course of study, he is sent to the college, or the technical school, and, a four years' course of higher education having been completed, he is sent into business at the age of twenty or thereabouts.

He has then, been engaged in the work of the student all his life; habits of study have been formed and, usually, he has become, to a certain extent, unfitted for the vastly different kind of occupation which is now to be taken up. He has acquired habits of study, a good memory, and the ability to utilize it thoroughly, and has learned to make logically correct deductions from properly grouped facts. He lacks usually, however, the power of quickly perceiving and promptly acting upon such perception. He probably lacks decision, has lost some of that strength of character which may have been his by inheritance, and he has none of that experience which is as essential as character and knowledge to success in business. He may possess a great store of learning, both general and professional, a well-trained mind, a sound judgment, and all that scholastic habits and training can give him, but he lacks the no less essential knowledge of men and of things which he can only obtain by a personal contact. He cannot manage his employés without either making unreasonable demands upon them or yielding to them more than is just. He knows nothing of methods of conducting business, and cannot have become accustomed to the hard rubs which so seriously disturb the tyro, and which so often discourage him at the outset.

Habits acquired in youth are always difficult to modify in later years. His habits are those of the student, and he must inevitably find it a seriously difficult matter to acquire the peculiar and distinctive habits of the business man. Once succeeding, however, he will rarely fail of full success.

The exceptional course in this country, and I presume in Europe, is the second of those outlined. The boy goes to the shop, or the office, immediately after completing his grammar or high school course, and learns the trade which leads most directly toward the profession which he proposes to enter; or, under the tuition of some practitioner, he acquires a knowledge of the ordinary routine of work and some idea of the character of the greater problem which he may expect to be confronted with in later years.

Arriving at the age of twenty, he sees the advantage of the possession of a knowledge of the science of his profession, and he leaves his practice for a time and devotes himself to study in some technical school.

His difficulty now is to acquire habits of study and the student's power of making his own that knowledge which he finds in books, and of grasping experimental data and of collating essential facts and grouping them systematically, and of deducing from them general laws of precise definition, and of well determined range of application. He has to re-acquire the mathematician's power of basing upon a statement of accurately defined conditions generalizations which find practical application in every department of human knowledge. He has to regain that fondness for research and study of which his business life has done so much to deprive him.

On the other hand, he has learned by experience to prize knowledge, both for its own sake and for what it will enable him to accomplish. He has learned in what direction he is to expect most aid from literary attainments and scientific knowledge. He can, to a certain extent, distinguish between those branches of study which give only a mental gymnastic training and those which enable him to accomplish two objects simultaneously—to acquire a store of valuable knowledge and, at the same time, to profit by a no less useful mental fullness of stature; becoming more of a sage and more of a man at the same time.

On the whole, I suspect that the advantages of this method more than counterbalance the disadvantages, and I have no doubt that, could this course be generally adopted, it would be seen to have an importance in the acceleration of professional progress which we probably hardly realize to-day.

Two great obstacles intervene to prevent the general adoption of this plan. The first is that conservatism which always retards the introduction of any thing new, and which usually makes it necessary to agitate for at least a generation before a really great change can be brought about. Even when all are agreed on the question of the propriety of a step such as this, it is usually a long time before the public inertia is fully overcome. This is well illustrated by the fact that the necessity of technical education itself—proposed two centuries ago, and fairly inaugurated a century ago by Vaucanson, the father of the great "*Conservatoire des arts et metiers*" at Paris—is only just now beginning to be universally acknowledged by even those who are not hampered by a traditional proclivity in favor of the old Greek non-utilitarian idea of a purely gymnastic system of education.

The second great obstacle is the natural, and almost universally observed, reluctance of the young man, who has once become fairly inducted into business, and who sees opportunities opening to him in the immediate future, to give up all and to return to the school to secure advantages which his reason tells him are still more important, but which he, nevertheless, cannot fully realize, looking upon them as he does from a standpoint which does not permit him to see them as distinctly as he may in after life, when experience has confirmed the previous judgment. An active, energetic, and ambitious young man can rarely bring himself to the point of going back to the school after having once tasted the pleasures of success in business. Where this has been done, however, it has been almost invariably the fact, if I may judge from my own observation of quite a number of causes, the result is a most encouraging one. Could this plan be generally adopted, it would not only be decidedly better for the young man himself, but it would prove vastly better for the schools.

The greatest difficulty met with in carrying out a satisfactory course of technical instruction in the schools, is that of finding students who have sufficient ripeness of intellect and of judgment, and sufficient physical strength to comprehend readily, grasp fully and retain perfectly, the principles which are presented to them. Boys are sent to technical schools without well-developed habits of study, with insufficient and superficial preparation, with minds unripe and with bodies still taxing their systems by the drain of that vital power needed in carrying on the operations of physical development. Were the last considered plan adopted, they would come to this work, which demands all the powers of maturity, with body and mind fully developed, and with an understanding of the extent, difficulty, and importance of the work to be done which would insure vastly better performance, and the accomplishment of vastly more in the time assigned to the course. The work of the instructor would be rendered more easy and more satisfactory to both himself and his pupil. The time would be far better utilized, and the greatest good would be accomplished in the given time and by the expenditure of the given amount of time and funds.

It is in this direction, I am pleased to find, that our President is looking for higher efficiency in technical training. If the plan which he proposes, of making our larger manufacturing establishments advanced technical schools can be carried out, it will prove, I am sure, a long step in the right direction. The final portion of the work of education would be done at a time when the student has attained sufficient maturity to appreciate it, and in the midst of such influences as will most effectually impress its value upon him. I sincerely hope that a way may be found of initiating this method of tuition, and that we may soon learn just what we are to expect from it. Difficulties will, undoubtedly, arise, but with the exercise of care in the choice, from among the many of the few who are adapted by nature and inclination to the pursuit of the profession, and with tact on the part of the instructor and a hearty good will on the side of the manager of the works, both, hand in hand, working for the accomplishment of an object the importance of which both appreciate, there can arise no insurmountable obstacle to final and complete success. When the schoolmen and the business men of the country put their heads together in the earnest desire to accomplish such an object, their united efforts will vanquish apparent impossibilities. I think that I can see this good time coming.

Mr. E. B. Coxe.—I, to a certain extent, had a practical education before going to the technical schools of Paris and Freiberg. During a portion of my youth I lived in the Lehigh coalfield of Pennsylvania, and having a liking for such things, spent a great deal of time in the mines, machine shops, foundries, etc., of that region, and made and assisted in making surveys both above and below ground. I found this practical education of immense importance to me in my technical education, enabling me to understand the details of mining, etc., when listening to lectures by the professors and studying the subject in books. There is another point to which I would refer. The mechanics we have at present are often men who do not serve regular apprenticeships, or if they do, work only at one or two nearly perfect machines; the amount of skilled labor in the large shops is being reduced to a minimum, one man works almost all his life at one machine, instead of at all sorts of jobs. A carpenter, to-day, gets almost all his work from the mills, and is more of a fitter or joiner than a carpenter, and few carpenters work more than a year or two as an apprentice. Years ago a carpenter or machinist had to learn his trade thoroughly, and hence he was more familiar with the details of his business, and would not require foremen of such ability as at present. A mechanical engineer should, therefore, be acquainted with details of work, so as to be able to utilize these imperfect mechanics. A machinist must now go to a country shop, where the

* See note at end of article.

machinery is imperfect, in order to become a thorough workman in all the branches of his trade. I feel it would have been of great assistance to me in my education if, before going into the technical schools, I had worked practically in a machine shop and foundry for a year or two.

In the paper under discussion, there is one point which seems to me to be worthy of more consideration; that is, what DARWIN terms the survival of the fittest. We always hear of the one man who, from a common miner, becomes a coal operator, but of the 150,000 other miners who do not, we never hear anything. One thing that cannot be learned in the school, and which an engineer should know, is how to deal with men; how to make them work in accordance with his ideas. You may make a perfect plan, and have a complete drawing, but if you cannot impress your master carpenter, machinist, or blacksmith, with the idea that you understand it and that it is a good thing, it will, probably, not work. They will get a bolt or something else wrong somewhere.

Another trouble is the difficulty of graduates in understanding that they are not civil engineers or mining engineers, but only fitted to study the practice of those professions. The word engineer has become mixed in its meaning. I had, some years ago, a cart driver. After a while I employed him to look after a small stationary engine. Now he is an engineer. I knew a slate-picker boy, some years ago. After a while he went with an engineer corps to carry stakes. He then became a chainman, then backsight man, and, finally, he got to use the transit instrument. Now he is an engineer. If business should grow slack they go back to driving carts and picking slates. So that many people imagine an engineer to be a person who drives a cart, runs a transit, picks slate, or tends a stationary engine according as trade is good or not, and the popular idea of what is the proper pay of an engineer is too often based upon such conceptions of what an engineer is. Graduates should at first be satisfied if they can make their board. They will, generally, make mistakes enough to cover what they think their wages should be.

Mr. OSWALD J. HEINRICH—I have listened with great pleasure to the remarks made by Prof. THURSTON, and I am extremely glad to perceive that he fully recognizes the principles indispensable for a thoroughly practical and theoretical education of young men desirous of adopting any of the technical professions for their future careers. I rise as a strong advocate of his last proposed course, which is, according to my judgment, based on a long experience in various different positions, the only thorough plan for ultimate success. The questions involved in this controversy are of such importance, that one interested in this subject as much as I have been, for more than thirty years, may be tempted to talk beyond the limited time which can be devoted to this subject now. Permit me, however, to make a few remarks, taken mostly from my own experience during business life, which has been based upon the courses pursued in my native country.

There cannot be the least doubt, that at no time in the past has a partial education and training been sufficient for a man to fill, creditably, any position of importance in the various callings of the technical profession, and we need not expect that it will be different in the future. While partial experience alone, even after a lifetime spent in a particular calling, may fit a man for a specific purpose, facts are not wanting to show that even such men may commit great errors, or even blunders, in disregarding well-known principles which would be thoroughly understood by those of far less practical experience, but who possessed a school education. It is true, a real good practical man, with indomitable energy, may succeed ultimately, but, probably, only after dearly-bought experience, which otherwise could be really avoided, and wasted time and money saved. This being the era when the state of cultivation of a nation is measured, to a great extent, by the most thorough use made of waste in material, we may just as well say, also, that this should be extended to the imponderable items of time and brain. On the other hand, a young man of a thorough theoretical education, may deliver a lecture before a set of practical men, which would fill them with admiration and awe, and yet he might be puzzled by the same set of men, if called on to show how to do some simple practical operation. But the result may be, that other practical men may exult over the apparent superiority of the "indomitable" spirit of the practical man (probably themselves too ignorant to judge of the cost of his experience), and sneer at the failure of the scholar, and thus bring discredit on the attempts at liberal education of mankind. A long life in various practical callings may fit a man to fill even eminent positions, and by being cautious, he may avoid such losses as have been enumerated; while, on the contrary, the unpractical scholar possessed, as it is frequently the case, of too much self-reliance and mere book experience, may waste time and money to overcome practical difficulties. It is, therefore, not surprising to see the scale often over-weighted on the practical side.

It follows, naturally, particularly in this country, that preference is given to the practical man. Unfortunately, for want of thorough understanding of the subject, the choice often falls upon a "so-called" practical man, and educational training has fallen into disrepute. The great drawback to obtaining a thorough, practical, and theoretical education in this country, will probably be less found in the means offered, than in the unwillingness to spend the time and money necessary to obtain it.

The order of the day in this country—"to make money," and, to a great extent, to judge the capacity of a man according to the amount of money he has, or is earning, will unquestionably be a great drawback yet awhile. On the other hand, it is also impossible to obtain sufficient knowledge and experience during a few years of training, and in one particular course of instruction.

Taking my own experience, I had the good luck, from my early boyhood until I had arrived beyond the years of maturity, to be alternately occupied in practical pursuits, as well as in educational training, at schools of various grades. Until I had arrived at the age of twenty-three years, I had never earned money worth speaking of, but spent my time from my fifteenth year in apprenticeships, and going to various technical schools and public works. In my country, boys intending to devote themselves to technical occupations generally pursue the following plan, partially, even, regulated by law. After passing through the higher grades of the common school (höhere Bürgerschule or realschule), up to fifteen or sixteen years of age, where even to some extent Latin and Greek, but particularly modern languages, and the elements of mathematics and natural sciences form a part of the system of instruction, they are regularly apprenticed according to the particular branch of business they intend to take up afterwards. As such, they pass their regular time as carpenters, masons, pattern makers, molders, machinists at mines or furnaces, etc. Generally, night schools, or schools during part of the Winter (handwerkerschulen)—industrial schools—are visited during their time of apprenticeship—the time so spent being allowed as regular apprenticeship. They receive little or no pay during their apprenticeship, according to choice and circumstances. After spending several years in this way, they enter the higher grades of the technical schools or colleges, to pass through a thorough course of scientific training, at the same time in various ways being constantly reminded of the practical duties necessary to be performed by them hereafter, by making excursions during the period of lectures, and during vacation visiting the public works and shops of the country. After graduating at those schools, they enter again for a time as volunteers at the different public works or private establishments, and are glad to be taken as such without receiving any compensation—sometimes even paying for the privilege. After such a course and proper examinations, they were only considered, even at private enterprises, to be fit to take a subordinate position, and often too glad to get it.

I consider a good general education more than desirable before entering practical life, for various reasons. The principal reason is that, the mind of the boy is more susceptible to mental training and exercise. During his apprenticeship, or attention to practical work, he will find out the great help he may derive from educational training. This is kept up by visiting the night or industrial schools during that time. These preliminary studies, connected with practical exercise, will balance mind and body, both essential for a youngster in those years of life. He will be by far a more attentive scholar at the higher grade schools, at least so far as my experience has gone, and will profit more by attending such schools than generally is the case with those who have first passed through the entire collegiate or classical course of studies. I consider this a very natural consequence of the necessary course of training in such schools, they being more designed to perform the functions for the training afterwards, than the old faculty studies of law, medicine, theology, etc.

I can only say this much from my own experience, if I had not been trained and educated in such a manner as described above, it would have been impossible for me to fight misfortunes and ignorance, which are necessarily encountered everywhere, and in a foreign country particularly, as it existed in former years even in this country, and to a great extent even now.

A man who has charge of a work may be as wise as Solomon, but, if he cannot show that he can lay the hand on the wheel himself, his subordinates will not confide in him. And this is particularly necessary in times of danger and difficulties, which may arise at any work. Being associated during his early days with the different classes of workmen, will make him more familiar with their notions, customs, and even their tricks, besides giving him at least some mechanical ability. Even if his constitution is not sufficiently strong to do a full days work of a laborer, he may be fully able to say when a man has performed a full and good day of labor.

It is easy enough for men to manage a business, where they are surrounded by good, able, and skillful men, or can get them at a moment's notice, as is generally the case in the old country, but it is absolutely necessary, in a partially unsettled country like this, for a man in such a position, to be in every respect capable of not only ordering a thing to be done, but also, if need be, to be able to roll up his shirt sleeves, and show how it should be done. But men educated in such a manner may even aid the working classes, who cannot devote their time to hard study, by giving them useful instruction during their daily vocations as well as during evening lectures, and I have had opportunity to test this matter to my great satisfaction, finding our mechanics here willing enough to receive instruction when opportunity is offered.

I will, in conclusion, only say to our young men: study hard, and as long as you can, but be also not afraid, if you can improve yourself by it, to soil your fingers or your coat, even if it is at a more moderate compensation than that of a first class superintendent.

NOTE BY PROFESSOR THURSTON.—The course of instruction in which workshop and laboratory practice is given simultaneously with tuition, in the several branches of study considered essential to the proper preparation of the student for professional work is becoming well recognized in this country as the most promising of good results, and a few institutions are endeavoring to give their students such a curriculum. A number of new technical schools are about to be organized, also, in which the same course will be attempted. Yale, Cornell, and Columbia, and the colleges at Bethlehem and Easton, and others, are pursuing such methods to some extent. The Rensselaer Polytechnic Institute at Troy set a good example of truly practical technical education many years ago, and the Massachusetts Institute of Technology is working in some departments on a similar plan. The Stevens Institute of Technology has been instituted, in deference to the character and wishes of the great engineer who founded and endowed it, as a School of Mechanical Engineering.

In the Department of Mechanical Engineering of that school, over which I have the honor to preside, I have endeavored to make the combination of theoretical, empirical, and practical instruction, to which I have referred as the third possible course, as complete as it could well be done within the walls of the college, and have complimented this tuition by as much instruction among the workshops and other establishments in the neighborhood of New York as opportunity can be found for. It would be premature to report definitey upon the result of this plan to-day. Several years must elapse before the real value of a method which aspires to make young men capable of going from the college into business and soon becoming efficient aids to older practitioners can be fully judged. I can only say that I originally allowed myself five years to determine whether it would be for my own interest to continue in a work which then seemed to me one of the noblest enterprises in which a member of the profession could engage, and, that period having nearly expired, I am not inclined to feel less faith than I had at first in its success, and have not lost any of the enthusiasm with which I took upon myself that task. With less kindly, persistent, and cheerful support and example than I find in the presence of my colleagues and of all the officers of the institution, I may have had a different feeling; but where all are working together in such a cause, discouragement should be impossible.

The student at the Stevens Institute of Technology enters after very much such an examination as is prescribed in all colleges of standing, and studies four years, at the end of which time he receives a diploma, which is to be taken as evidence that he has pursued with credit a course of study which is intended to be a suitable preparation for the commencement of actual work, and for beginning to learn the business of construction. He is called a mechanical engineer, which is to be interpreted as meaning that he is considered to be well fitted to *become* a good engineer. The first two years of his course are preparative, and during that time he is acquiring a good knowledge of the ordinary college courses in literature, mathematics, and the physical sciences, somewhat amplified and modified in directions which tend toward future practical applications. The next two years are devoted, principally, to professional studies, and to the application, in the laboratories and shops, of the scientific knowledge previously acquired. The student works in the chemical laboratory, on analyses of ores, metals, and the materials which he expects to make

use of in his future life. He spends a considerable amount of time in the physical laboratory, making experiments upon whatever has a bearing upon his professional work, and learning the methods and the use of apparatus which are needed in all work of precise measurement, and he there becomes thoroughly and intimately familiar with all that the college student usually only knows by hearsay and by eyesight in the auditorium. Here his hands become expert in manipulati on, and he feels and realizes all that we, who were less fortunate in our college days, barely omprehended, and never fully appreciated.

It is only here, and by these means, and with such actual tactual practice, that the student can be taught habits of accuracy, and an understanding of the difficulty which attends the acquisition of valuable experimental data. His mental training here is, by no means, the least important part of the work. In mathematics, he pursues the higher branches, an l devotes much time to applications throughout these two years. His instruction in the drawing-room extends throughout the full course. The earlier portion of this time makes him familiar with the use of instruments, and he gives much time to the graphics of descriptive geometry, and the studies to which that forms the introductory. During the final portion of his course in that department, if he has any inventive power or ability to design, he makes original designs of machinery and apparatus. The machines for testing metals, and for testing lubricants made in the mechanical laboratory, were designed no more or less entirely by students.

In the department of engineering he devoted these two years to the study of mechanical science, and to obtaining a knowledge of his materials of construction. He studies the construction of typical machines, and the form, as well as the theory, of the prime movers. He goes into the workshop two days in the week, and there learns the construction, the use, and the manipulation of machine tools. He acquires a little of the mechanics' "knack;" if he has a natural sleight, he gets a good deal of it. He there sees work going on in the hands of more experienced mechanics, and gradually acquires that kind of familiarity with such matters, which is so essential to his future success. He goes into the little foundry and sees the molder at work, and soon knows the technic of that business. More or less work in pattern-making, and the other subsidiary trades is usually going on, and he picks up enough in the shop, and from the lectures on the trades, to be able to advance rapidly when he finally goes out into real work.

The mechanical laboratory, which has been founded during the past year, is doing a considerable amount of work for private individuals, railroads, and other large corporations, and has done much experimental work for the neighboring Municipal, State, and United States Governments. This has been of immense value in giving the students an opportunity to witness, and frequently to take part in, experimental determinations of important facts and data.

They use daily the apparatus of the engineer in the lecture room and become familiar with the forms of the machines for determining the tensile, torsional, and transverse strength of materials, the steam engine, indicator, etc., and occasionally have an opportunity to take part in the experimental work which is every day in progress. Students have taken part in tests of all kinds of materials of construction, of steam engines and boilers, pumps, and other machinery, and have used the dynamometer, the pyrometer, and all the instruments used by the mechanical engineer in his professional work. They have taken part in some very important investigations and in some valuable original scientific researches. The exceptionally complete outfit of this mechanical laboratory, and the wide range of work obtained by it in doing its work, as a matter of business for all kinds of business men, gives opportunities which, confident as I was of its ultimate success, did not, when I first attempted its organization, even imagine. It gives all these advantages, and what is hardly less important, it pays its own expenses.

Viewing this experiment as a whole, from our present position, I can say that I see no reason to doubt that it is destined to prove itself as complete a success as its most enthusiastic friends have even hoped.

I have given this somewhat full account of the way in which this problem of technical education is taken up at the Stevens Institute of Technology, partly as an illustration of an actual and earnest attempt to carry out the method which I have referred to in my remarks and partly for the purpose of giving those members who asked for more information a concise answer to their questions. I hope that I may have succeeded in interesting still more those who have exhibited a desire to see our methods of technical education perfected, and a high "modulus" of efficiency attained.

THE HYDRAULIC MINING PROBLEM.

THE following letter, addressed by LOUIS A. GARNETT, President ot the El Dorado Water and Deep Gravel Mining Company, to HAMILTON SMITH, JR., Manager of the North Bloomfield Gravel Mining Company, is worthy of careful perusal just at the present juncture :

SAN FRANCISCO, Feb. 5th, 1876.

HAMILTON SMITH, JR.—MY DEAR SIR : Finding it impossible to accept your kind invitation to accompany you to Sacramento, agreeable to your request, I herewith submit a very hurried memorandum of some of the more important considerations touching the great industry of gravel mining in this State, which have occurred to my mind, and which, perhaps, you might touch upon with advantage in your contemplated report upon the subject to the legislative committee on mining.

My business occupation for the past twenty odd years having brought me constantly in contact with the production of the precious metals on this coast, I have naturally noted certain phenomena resulting from the relations existing between our mining operations and other collateral industries, which are, perhaps, but little understood by the public, and which will show that there are certain commercial considerations underlying this question of the highest local as well as national importance.

I deeply regret the tendency which has been developed in certain quarters to antagonize the two great leading industries of the State, which should be adjunctive and co-operative, and to indulge rather in exaggerated estimates of damages, than to devise or suggest expedients for relief. No good can possibly come from so unwise a policy, while much injury may be indirectly inflicted by impairing the credit of mining enterprises.

I will only pause to remind those who adopt this course, that this State has now produced over one thousand millions of gold which is the basis of all of our present prosperity and material wealth, and has fostered and built up the very industries which now seek to abolish or embarrass this great source of wealth and which, indeed, has created the very value which it is now alleged, has been so much depreciated by hydraulic mining. As great as this sum appears, which we have thus added to the world's wealth, it is well known that it does not constitute a tithe of the vast stores of wealth which still lie buried in our deep gravel deposits, and which will constitute a profitable field for labor and capital for centuries to come. But as vast as this production has been, and as boundless as the capabilities of our great fields for the future are, but few perhaps, are aware that the production of gold in this State has declined from some $90,000,000 reached in 1853, to scarcely more than $15,000,000 in 1875, of which latter sum not less than two-thirds were from gravel deposits and to which it is now well understood we must, for the future, look to a still greater extent for our supplies, and which from the extensive enterprises recently completed or projected, must be steadily on the increase.

This production has been now for several years past, wholly inadequate to withstand the inevitable demands which the exigencies existing elsewhere created, and at the same time to maintain unimpaired the volume of our circulation, to say nothing of the increase necessary to keep pace with the expansion of our business and increased volume of commerce generally. Nearly the whole of the stringency of the money market here and the consequent embarrassment of our industries which has existed, to a greater or less extent, for the past five years, has been entirely due to this inadequacy of volume of circulation to the volume of business. This has notably been the case for the past two years, and but for the accidental circumstance of the greatly increased production of the Comstock within that period, and the gold derived from that source, we would have witnessed, ere this, a financial and industrial revulsion which would have produced a universal paralyzation of business, if not absolute bankruptcy, from which it would have required us years to recover.

A simple statement of the actual figures will sufficiently demonstrate this fact. Of a total gold coinage by the mint here in 1874 of $24,460,000, over $7,500,000 were separated from Comstock silver bullion. Of a coinage of $24,674,000 in 1875, over $8,500,000 were from the same source, making within the two years $16,000,000 of our supply from this quarter, which added to about $4,000,000 coined at Carson, gives us the round sum of $20,000,000 or 37½ per cent. of our entire coinage which is believed to be fully equal to the entire volume of our actual circulating currency at the present time, and without which, it is unnecessary for me to even indicate the embarrassment under which we would be now laboring. Notwithstanding, however, the timely relief we have received from this source and the magnitude of recent developments on the Comstock, it may be but a few years when we shall find ourselves again thrown back upon our own supplies, with a greatly increased volume of business to provide for, and with the uncertainty of our cereals, and gold mining prohibited or impaired by unwise legislation, it requires no particular foresight of financial sagacity to foresee the universal stagnation in all of our industries which must inevitably ensue. It will be thus seen that this is not simply a question between our agricultural and mining industries, but one in which every industry on the coast is interested, and while I am in favor of meeting this question squarely and at once, and eliciting intelligent inquiry into its merits as a basis of future action, I deprecate all exparte and captious statements upon the subject and would decidedly favor the memorial to Congress for the appointment of a commission of competent engineers to examine into the whole question.

In considering the issue which has been directly made by the friends of our agricultural interests, your personal experience and familiarity with all the phenomena of hydraulic mining will doubtless supply you with all the essential facts and considerations necessary to vindicate this important industry. Yet it may not be altogether uninteresting to you to learn the fact coming with in my personal knowledge and experience in the projection and management of a very extensive mining enterprise, but recently inaugurated and just entering upon active operations. These facts may be cumulative and confirmatory of those gleaned from other sources.

The El Dorado Water and Deep Gravel Mining Company, organized by me something over two years ago, for mining and agricultural purposes is, by purchase, the successor of some four other companies who had acquired various water and mining rights under existing laws, upon the South Fork of the American river and its tributaries, embracing a water shed of some 500 miles, and sundry lakes, and natural reservoir sites of greater or less storage capacity, at the summit of the Sierras, and varying from 7,000 to 8,500 feet of elevation. Our predecessors had, since 1851 expended over $1,000,000 in the construction of some 144 miles of mining and irrigating ditches, and our company has since expended some $800,000 more in the construction of a main trunk canal 32 miles in length, the damming up of lakes and other necessary operations connected with this scheme. We have now just introduced an abundance of water for all immediate purposes (which will be increased from time to time as required), into an auriferous gold belt, aggregating some 300 square miles in exterior limits. This water is supplied at an elevation of some 2,000 feet above the natural bed of the American river, thus rendering valuable for agricultural purposes an area of country heretofore almost worthless, greater in extent than all the lands destroyed or damaged by hydraulic mining in the entire State. And it is the purpose of our company to ultimately utilize our entire catchment and storage capacity, and greatly extend the area of land subjected to irrigation, now well known to be the greatest desideratum of our agricultural pursuits. I will simply state that in addition to the lands already rendered susceptible of irrigation by us, the storage capacity of the Glacier, Medley, Echo, Audrain, Twin, Silver, and other lakes owned by us, is susceptible of being still further increased, so as to be adequate to the supply of 3 inches of water per month, for 4 months of the year, over an area approximating 200,000 acres of land, and that the previous use of this water for mining purposes greatly increases its fertilizing properties. To say nothing, then, of the direct results, we expect to produce from mining operations, the benefits and advantages which will be incidentally secured to agricultural and kindred pursuits, will greatly exceed any damage which can possibly result. But we confidently expect, however, within the next two years, to increase the gold production of this county alone at least $2,000,000 annually, and as the auriferous deposits are practically inexhaustible, it would seem to me that upon every principle of public policy the utmost encouragement should be given to this great staple industry of our coast, which, to a great extent, is free from the disasters and vicissitudes which periodically overtake our other leading industries, and is a source to which we can always look for relief when other resources fail. Indeed, if we are to maintain our metallic currency, which has been so notably the basis of our prosperity, when universal depression and ruin are existing elsewhere ; if the federal government ever hopes to resume specie payments, such a course will be absolutely indispensible. For in the general decadence of gold mining in other parts of the world, the aggregate annual production has now become much less than the consumption as shown for the past ten years, and these factors are now operating as inverse ratios, and to my mind this constitutes the chief practical difficulty of maintaining in the country a metallic reserve adequate to the

redemption of the paper money in circulation, and consequently of resumption. To my mind this question is not susceptible of any partial solution or local relief. I do not conceive that it is competent for either the Legislature or Congress to say that mining may be carried on in one locality and not in another. It is absolute prohibition or nothing, and the former, I conceive is simply out of the question. The only thing to be done is to find out the remedy, if any exists, for the evil complained of.

Many other interesting facts could be stated in connection with this subject, but as you are doubtless familiar with them, I will not attempt to anticipate you, and besides I feel that I could not do the subject justice under such a pressure for time, and have to beg your indulgence for the inevitable crudeness of the suggestions I have already thrown out so hurriedly, and which I have no time to revise. In great haste, yours truly, etc., LOUIS A. GARNETT.

BLAST FURNACE HEARTHS AND IN-WALLS.*

By E. C. Pechin, of Dunbar, Pa.

AT the September Meeting of the Iron and Steel Institute of Great Britain, Mr. CHARLES WOOD, of the Tees Ironworks, read an interesting paper on "Further Improvements in Blast Furnace Hearths," which was followed by an animated and instructive discussion.

If the durability of hearths and in-walls is a matter of interest in England, where furnaces stay in blast from eight to twenty years, it certainly becomes us, in this country, where furnaces are blowing out every few years for repairs, to ascertain, if possible, the cause of such rapid deterioration, and whether it cannot be avoided.

As Mr. BELL, in the discussion above referred to, observes, the difficulty lies in comparing the durability of a blast furnace in one district, with one even of the same construction in another district.

Here, where we have every variety of fuels and ores, compelling modification in both furnace construction and the working of them, it is almost hazardous for one to express an opinion outside of his own particular district.

The subject, however, is an interesting one, and its introduction may result in discussion and further consideration, which may prove of general value. In this paper, the writer only proposes to give his own experience, making a few observations generally applicable, excepting in those cases where, owing to certain peculiarities in the materials used, special considerations must apply.

The two particularly vulnerable points in the interior of a furnace, are, first, immediately under the tunnel-head, where the constant abrasion of the stock wears away the brick, and second, the crucible, where the intense heat tends to destroy both the floor of the hearth, and the hearth and bosh walls.

The former is not of much moment, as the upper half of the furnace walls can be readily rebuilt, by a stoppage of a few days, and the simple precaution, adopted in the Lehigh Valley, and probably elsewhere, of inserting cast angle iron between the layers of brick, which receive the shock of the falling stock, will render this portion of the in-wall as durable as any other part of the furnace.

The destruction of the hearth, (and by this term is included, for present purposes, the floor and the side walls above the zone of fusion) is a far more serious matter, for when a certain point is reached, the furnace must be blown out.

Mr. WOOD, in his paper, exhibited a diagram of a Cleveland furnace after it had been at work eight years. He stated that he had proof, however, that it had attained its then dimensions, after it had been blowing between five and six years.

"The original diameter of the well was nine feet, while the thickness of the walls was five feet, making the outside diameter of the well nineteen feet. The wall or brickwork was reduced to about two feet six inches in thickness, and in places where the brickwork was very liable to get very hot from contact or from non-radiation, it was thinner than this, particularly close to the hearth line, where the thickness was reduced to about eighteen inches. The original well had therefore extended from nine to sixteen feet in diameter. Nor was this a solitary case. In eight furnaces which had blown out at the Tees Ironworks, although of very different dimensions, the walls and hearths were found in a similar condition."

He goes on to state, what every furnace-man will appreciate: "When the furnace linings are burnt out to dimensions approaching these, the furnace is best blown out. It is utterly impossible to regulate the quality of the iron, and the blast cannot be either directed or concentrated, which is so necessary to perfect fusion. One day it will be found that the furnace is working hot on one side, or that the slag will quickly turn black, or is difficult to run, or the furnace will scaffold, and large lumps will come down, and these lumps being difficult to fuse, will lie for hours in front of the tuyeres, turning the current of the blast in another direction. Now these are conditions rarely found or combined in a new furnace, where the hearth and walls will be in a proper shape, but common enough when burnt out."

Mr. WOOD, then criticizes various points of practice, proposes a peculiar arrangement of his own, operating as a closed front, and avoiding the dangerous (as he considers them) points in LÜRMANN'S front, and concludes as follows: "With tuyeres equally divided round the furnace, a closed front, boshes and crucible walls protected from the heat, and with a good hearth bottom, we may hope to insure, not only regularity in the quantity and quality of the iron, but also durability of the furnace, combined with economy in working."

In the discussion following, Mr. THOMPSON, of the Clarence Works, condemned the LÜRMANN front, and believed it a good plan to have a road into the furnace, after standing two or three days. Mr. WILLIAMS, of Middlesborough, was going to thicken his walls instead of thinning them, as MR. WOOD proposed; and as to the wearing away of the crucible walls, and its size increasing, he believed that the remedy was in pushing the tuyeres further in.

Mr. LOWTHIAN BELL considered that it was a matter of very great importance that they should preserve, as far as possible, the shape of a blast furnace, and that although heat would undoubtedly be lost from the use of thin walls and water jackets, yet they must chose the lesser of two evils. Mr. SNELUS and Mr. WM. WHITWELL strongly endorsed the LÜRMANN closed front.

Thus, it will be seen, how varied are the experiences and opinions of men regarded among the foremost in their profession, and many of them working under similar conditions.

With this introduction, your kind attention is asked to a brief statement of the workings of the furnace which, for several years past, has been under the writer's management at Dunbar, Pa.

The materials used have been of a uniform character. The large proportion of the burden is of native ores, mixed with mill cinder and Lake Superior ore. These native ores are very silicious, containing from 11 to 16 per cent. of silica, requiring the use of a large amount of limestone, about 1 4-10 tons to the ton of iron. The furnace is 15 feet 6 inches in the bosh, and 58 feet high. When blown in, the diameter of the hearth was 5 feet 10 inches, and the extreme width of the bosh is reached at a distance of twenty-eight feet from the floor. It was blown in October, 1870, and has been running continuously since, producing over 52,000 tons. The average richness of the ores charged is about 50 per cent, and the product for the last twelve months has been over 13,000 tons, of which 94 per cent. was foundry and No. 1 mill iron.

Attention is simply drawn to these details, as evidence that the hearth and in-walls must have been in good condition, and have been free from any very great enlargement, or irregularity in shape, otherwise these favorable results would not have been obtained.

The floor of the hearth is of blocks from the Mahoning sandstone, which caps the neighboring hills, and has been in use for eight years, in the present and the preceding blast. The walls of the crucible, for 10 feet up, are of Mount Savage brick of the ordinary size, and the balance of the in-walls are of the common hard 9-inch brick, made at New Cumberland, on the Ohio River. There is not a shaped brick in the furnace, and the boshes and in-walls are carried up continuously from the floor of the hearth.

Various inquiries have been made, from time to time, regarding the use of the 9-inch brick for in-walls. With our present experience, we would continue using them. Their use is quite common in Pittsburgh, and with satisfactory results.

A more uniform degree of hardness can be had in these small brick. In large lumps or shaped brick, oftentimes, it will be found that although the outside is well burnt and hard, the inside is soft and friable. By laying the small brick as headers and stretchers in alternate courses, the whole mass is thoroughly tied together. The objection has been urged, that, if cutting began, the small brick would rapidly give away; this, however, does not appear to be the case, but the surface of the bricks wear off uniformly. Apart from the low cost of this class of brick, much more rapid work can be made in laying them—there is no assorting of different sizes and shapes, and after the crucible is in, and the tuyere arches in, any intelligent laborer can lay the brick quite as fast, and as well, as a skilled bricklayer, the principal point being to get them close together, and as firmly bedded as possible.

A very grave mistake is frequently made in the use of fire-clay. The writer knows of a large, fine furnace, whose in-walls tumbled in a mass, a short time after blowing in, simply by reason of the contraction of the fire-clay mortar used in excessive quantities between the bricks. He knows of another, now building, where he anticipates the same result from a similar cause.

This mistake is made by one man, so experienced, that he can't be wrong, or by another, so fresh, that he thinks he can do with impunity what other people can't, but the result in either case is equally disastrous to the owners. The thinnest possible film of well boiled fire-clay that will set the brick is all that is needed, and in proportion as this is attended to will be the excellence of the work. Another most material point is to have the furnace thoroughly dried out before blowing in, and too much care cannot be exercised in this direction.

The interior lines of a furnace would seem to have a vast deal to do with the durability of in-walls. Common sense and good practice teaches that the lines should admit of the easy and regular descent of the stock, so that the ascending gases perform their duty with uniformity and precision.

Some years since, the writer examined a large, modern and splendidly equipped furnace, just as it was completed. Instead of following the approved lines of the best English and American furnaces, the originator (an English constructionist then in repute) had carried up the well-shaped crucible some four or five feet above the tuyeres without any batter, and from the top of this hole had battered off the boshes.

In reply to an inquiry, as to why this peculiar shape was adopted, he said that he had no particular reason, excepting that he had once lined a furnace in this way and that it had worked well, so he was trying it again.

The furnace blew in, and shortly began making very bad iron, so bad, that it was rejected by the mills as worthless. The stock was excellent, but the furnace worked very irregularly, improving somewhat, however, when, losing bell and hopper, she was shoveled out after a six weeks' run. The writer at once went to see her, as the opportunity of examining what a first-class furnace can do in the first six weeks of a blast is not often presented.

The secret of the bad iron was readily explained; the furnace had been running Mt. Savage brick at $50 per thousand into the pig iron, and had been doing her best to get rid of the obstructions which a stupid man had interposed. In the main, she had cut away the brickwork, and had worked back into a somewhat reasonable shape, but leaving lumps and ridges, which prevented any regularity in working. In repairing, an easy and gradual slope was given from the tuyeres to the boshes, and she has since worked very well indeed, both as to quantity and quality. The moral of all which is, don't waste Mt. Savage brick.

We have always considered that the large and regular yield of Dunbar was largely due to her lines, which were copied after English furnaces of reputation, and after obtaining the results of similar lines at the Crane Ironworks in the Anthracite region, and at the charcoal furnace of the Jackson Iron Company at Lake Superior.

There is, probably, no furnace contrivance of late years which has been received with such a difference of opinion as the LÜRMANN closed front. Of those who have tried it, some as heartily praise as others strongly condemn, but it will be found as an almost invariable rule, that the latter class have attempted to introduce it while the furnace is in blast. There is no good reason why, with its proper application, it should not be entirely successful. That great economy in fuel results from a closed front is undoubted, but there is a great force in Mr. THOMPSON'S position that it is a good thing to be able at times to get easily and quickly into the furnace.

The writer's experience with a LÜRMANN front was an unfortunate one. He never recollects days of greater toil and anxiety than in his attempt to introduce it in 1871, and it was only when the tuyeres were nearly reached by the chilled iron that it was taken out. It is only just to Mr. ASMUS to say, that he then stated that he would never again attempt to put it in while the furnace was in blast, as it seemed impossible to make a good job. Since this attempt we have been running with a closed front of our own construction, and which can be readily applied to any furnace; it is simply letting the crust alone. We run for six months at a time without ever disturbing it, and if at any time it is necessary to open up it is easily done, and as easily closed. Opening at every cast, and poking away with bars, destroying tools, losing valuable time and cooling the furnace, is a relic of a barbarous past, and no good furnaceman will practice or permit it. But all appliances and contrivances avail little if the hearth cannot be saved. If it be badly cut, the use of a titaniferous ore will

* A paper read before the American Institute of Mining Engineers, at the Cleveland Meeting, October 26, 1875.

soon make it up. In fact, if one chooses to use enough of it, he can make up so effectually that he will soon be casting over the dam, and if he keeps on long enough he can soon be not casting at all. Even if no such means are available, any cutting below the tuyeres can be gotten at and remedied, but cutting at, and above the tuyeres, is a more serious matter, and where the real danger lies. From the experience of his own and that of valued friends, the writer can confidently recommend the tuyere cooler of Mr. THOMAS MCCUNE, formerly in charge of the Eliza furnaces near Pittsburgh, and now manager of the Charlotte furnace at Scottdale, Pa., as a certain preventive against cutting. It was introduced at Dunbar some three years and more since, at a time when the furnace was cutting badly; the tuyere breasts were red hot, compelling the constant use of water upon them, and at intervals both cinder and iron breaking out.

Since the coolers were put in, not the slightest trouble has been met with. The original cooler is in one arch, and one replacement has taken place in the other arches. As an indication of the positive effect of this cooler, on one occasion, a cooler was burnt out, and not replaced for several months. Cutting commenced and worked back, behind the front face of the cooler, until the cinder broke out. A new cooler was inserted—the cutting was at once checked, and the walls began making up.

Some six weeks since, the Charlotte Furnace, which was in blast when Mr. MCCUNE took charge, and only provided with the common form of a semi-circle around the tuyere, was so badly cut away, that it was deemed impossible to save her, as the walls were reduced to a mere shell. Five of these coolers were put in, and a personal inspection a few days ago, showed the furnace in as good condition as ever, and doing larger and better work.

The advantages of this cooler are, the large cooling surfaces presented, and the impossibility of the tuyeres changing position. As they are placed, so they remain. A minor consideration is the ease with which a tuyere can be withdrawn and replaced. Where no lump had formed on the nose of the tuyere, we have drawn and replaced one in ten minutes.

It will be generally conceded, that the giving way of the in-walls begins at or near the tuyeres. Being hollowed out there, the descending stock carries away layer after layer of brick, until the in-walls are so furrowed and scarred, as to prevent further successful working, and compelling a blowing out. Is it not reasonable to suppose that if the start is prevented, the ending is undoubtedly postponed? If a furnace-man is convinced in his own mind, that his difficulty commences at this point, he may rest assured that with the use of this form of cooler, he can overcome or avoid it.

In this desultory paper, the writer can scarcely claim that he has given anything novel or instructive, but he has done what he started out to do, given his own experience, and if in so doing he can induce others to do likewise, or has been of the most immaterial service to any one, he will be satisfied with having made the attempt. If a dead American humorist were with us, he might possibly exclaim at the end of all this, "this is sarcasm."

In the present condition of the iron business, to tell a man how he can keep his furnace in blast, would seem to be the suggestion of bitterest enmity—to compel him to go out, whether he wanted to or not, might be an act of the highest and most disinterested friendship.

DISCUSSION.

Mr. FRANK FIRMSTONE agreed with Mr. PECHIN as to the importance of having the joints in the fire-brick as thin as possible, but there was a limit to this in the varying thickness of the bricks. The joints must be thick enough to take up the irregularities of the bricks, and leave the top of each course level and even. This could be done by mixing clean powdered fire-brick with the clay, to make a sufficiently thick mortar. By this means there was no danger from shrinkage. He had no doubt hearths might be rammed up entirely of powdered brick and clay, but for the trouble of drying them properly.

Mr HOLLEY inquired if much progress had been made in monolithic linings.

Mr. PECHIN replied that they had been used, and had proved both successes and failures; the difficulty in the latter cases seeming to be, that they were not sufficiently dried.

Prof. EGLESTON said that throughout the Continent of Europe, each brick was dressed with the greatest care, and each layer carefully leveled, in order to secure a perfect lining. Monolithic hearths were almost universal in Silesia, where they were inclosed with sheet iron and cooled with water.

Mr. FIRMSTONE said while the practice of carefully chipping the bricks down in every course, no doubt, made excellent work, he never permitted it to be done, as it was an entirely needless expense. The same end was attained by the use of properly mixed clay and pounded brick.

Mr. ASMUS said that the practice of making hearths of large brick—ten inches thick, and two to three feet long—was quite common in Europe, the bricks being accurately pitted together outside the furnace before putting them in. Joints of powdered brick and clay had been found to shrink as much as 25 per cent.

Mr. BIRKINBINE said that the furnaces of the Meier Ironworks at St. Louis were built of chisel-dressed bricks. He had heard of one furnace at Stockton-on-Tees, in which a hearth of fire-clay and ground brick had been put in.

Mr. BOYER gave an instance of a furnace in which a furnace-hearth bottom had been cut out eighteen inches. This was replaced by broken fire-brick and clay, stamped down, and had stood three years of working, and was then in a better condition than the original sandstone. He had also put a monolithic breast in a furnace, and had blown twenty months.

L'OISEAU'S COMPRESSED FUEL.

WE have several times described in this JOURNAL, the ingenious machinery used by Mr. E. F. L'OISEAU in manufacturing artificial fuel from anthracite coal-dust, but as the new works at Port Richmond, Philadelphia, are shortly to contribute to the supply of the coal market, we give the following description, from the New York *Tribune*, of the process of manufacture:

The new fuel is composed of 95 per cent. of coal-dust and 5 per cent. of clay, with a small amount of a glue-like mixture made of rye flour and slaked lime. It is in pieces of the shape and size of hens' eggs. To make the pieces impervious to water, they are dipped in a solution of "candle-gum," a residuum of paraffine, and crude benzine. All the manufacturing processes are novel and ingenious. The clay is dried in an oven on sheet-iron plates, the fire being in an iron car running on a track so that it can be pushed forward or backward under the plates. Then the clay is hoisted up to an upper story, pulverized in a mill, and deposited in a wooden receptacle. Close at hand is an iron boiler 8 feet in diameter and 8 feet high, in which the paste is cooked by steam and stirred by revolving paddles. The paste is of the consistency of thick cream, and escapes by a pipe at the bottom of the churn. The coal-dust is drawn up on an inclined plane in small cars and thrown upon an oscillating wire screen, which takes out all pieces of slate or small chunks of coal. As the dust falls through it is carried in an endless chain bucket elevator to a bin holding five tons. Now the dust and the clay fall down into a curious little machine, that measures out just the proper proportion of each, and throws both ingredients of the future fuel into a common receptacle. But while they are dropping into this receptacle they receive a sprinkling of the liquid paste from perforations in an iron pipe. Another chain elevator takes the commingled ingredients up and deposits them in a huge iron churn holding six tons, in which are seven revolving shafts, that swing their great toothed arms about in opposite directions and thoroughly mix the black grist. The substance is now of the consistency of moist sand. It falls upon a leather band, and is carried to the hopper of the pressing machine. This consists of two iron cylinders, 30 inches in diameter, and the necessary apparatus to revolve them. The cylinders are each indented with 870 large molds and 56 small ones, and as the molds on the two come together they press the soft mixture into shape, and afterward drop the egg-like chunks upon a moving wire-cloth belt below. The larger pieces weigh 2¼ ounces each, and the smaller ones half an ounce. Thus far the operation has been wholly automatic, and so it continues to the end. The egg-coals, as they might well be called, must now be dried. They are dropped upon another wire belt that carries them into a great oven heated to a temperature of 250 degrees, and fall successively upon still other belts traveling in opposite directions until they have gone the length of the oven five times. When they come out they are ready for burning, but must be "water-proofed" to protect them from dissolution if caught in a rain-storm. For this purpose another traveling wire belt, across which there are upright partitions of wire, catches them and gives them a bath of two seconds in an iron tank containing a solution of candle-gum and benzine. The tank is inclosed to prevent the escape of the fumes. From the tank the coals go to a big bin called the evaporator, which holds 15 tons. The benzine fumes rise through pipes to a condensing-coil, and the recovered liquid is conducted back into the tank from which it ran into the bath. After remaining about an hour in the evaporator, the coals fall upon another moving belt, which deposits them in the final receptacle—the "pocket"—from whence they roll into the coal carts.

From the time the clay went into the mill and the coal dust was emptied on the separating screen the material has traveled a distance of 743 feet without being once handled. In the succession of ingenious automatic processes lies the secret of cheap manufacture. The factory will produce 150 tons a day with one set of machinery, and the product will be sold for $1 a ton less than the price of stove coal. Contracts have been made for all the coal-dust at the Richmond wharves—the shipping point of the Philadelphia and Reading Railroad, and for an additional supply from the Lehigh region. In the mining districts the dust accumulates in huge piles around the "breakers," and has no commercial value. The new process of making fuel therefore utilizes a waste product and develops a new industry that promises to be of great importance. The new fuel will be shown at the Centennial Exhibition in a large iron pavilion to be erected near Machinery Hall. Cooking stoves, parlor stoves, and open grates will be placed in the pavilion to show the combustible properties of the fuel. It is said that a ton of it gives 25 per cent. more heat than a ton of stove coal.

NOTES.

THE ESPINASSE PUDDLING FURNACE.—The Firminy Iron and Steel Company have already put up four of these furnaces, which have been at work three months, and six others are to be erected before long. From tables supplied by M. VERDIE, of the results given during the month of last November with the Espinasse compared with the ordinary furnace, in the manufacture of puddled steel, it appears that the saving in scrap for the maintenance of the hearth is about 11 kilogs. (30 lb.) per ton of the metal dealt with, that the production is increased by 35 per cent., that the waste is slightly less, that the consumption of coal is reduced by about 31 per cent., and that the cost of labor is reduced by about one-third. The quality of the metal produced is good, being much better than that turned out by hand. The paddles last about 12 days, and the lower part of the shaft carrying them need only be renewed after a month's working. The total cost of maintenance per month is 23 fr. 70 c. 18s. 11¼d.) as compared with 47 fr. (37s. 7d.) for the ordinary furnace.—London *Iron Trade Review*.

METHOD FOR DETERMINING THE VALUE OF COALS.—Mr. L. THOMPSON, M. R. C. S., publishes the following as a convenient method for getting the economic value of coals: The apparatus required is a small cast iron crucible about the size of a common tea-cup, and furnished with a lid. This crucible should be as light and thin as possible. The one the author now uses weighs 6 ozs., holds 4 ozs. of water, and cost one shilling. Having obtained a fair sample of the coal—which is rarely practicable except 1 cwt. has been crushed under edgestones—reduce an ounce of this to an impalpable powder, and carefully mix 10 grs. of this with ¼ oz. troy of common salt, previously dried, and then add and thoroughly mix with this 1 oz. troy of bichromate potash; place the mixture in the crucible, put on the lid, counterpoise the whole with great care in the scales; then, allowing the counterpoise to remain, place the crucible in a common fire where it may become dull red-hot, and allow it to continue so for a quarter of an hour; after which take the crucible from the fire, and when cold, place it again in the scales, and notice how many grains it has lost; then, deducting from this the weight of the coal (10 grs.), the remainder represents the quantity of oxygen carried off by the really useful combustible constituents of the coal. This he has found to vary in the coals supplied to the London market from 19 to 28.—London *Chemical News*.

RESEARCHES ON THE PURIFICATION OF CAST IRON.—The sample of cast-iron which was used during these experiments, gave, on analysis, the following average composition:—Column *a*.

	a. Per cent.	*b*. Per cent.	*c*. Per cent.
Silicon	2·76	1·50	0·58
Graphite	4·58	3·23	....
Carbon	1·20	1·98	....
Iron	90·40	93·24	99·40
Manganese	0·90	....	....
Sulphur	0·16	0·05	0·02
	100·00	100·00	100·00

This sample was melted in a small cupola, and the ingots obtained were analysed. The analysis showed that the amount of silicon and sulphur diminished and that a part of graphite was transformed into carbon. The results of this analysis are as follows:—Column *b*. A second experiment was made; the sample of cast-iron was melted with a mixture of crude soda (1 per cent) and manganese dioxide (0·5 per cent.). It was found that the resulting metal contained the following amount of silicon and sulphur:—Column *c*. It was found well to add to the melted mixture a small quantity, about 3 per cent., of fluor spar. Some metallurgists have proposed the use of soda for refining cast-iron; my experiments showed me that a modification of all these processes may be proposed, consisting of melting and refining the metal at the same time. The metal is melted in puddling or refining furnaces, and when the metal is fluid, into the furnace is thrown a mixture of 3 per cent. of fluor spar, 1 per cent. of crude soda, and 0·5 per cent. of manganese dioxide for every 100 parts of the melted cast iron. This process gave very good results.—SERGIUS KERN, in the London *Chemical News*.

REPORT OF QUICKSILVER MINING COMPANY FOR THE YEAR ENDING DECEMBER 31, 1875.

THE report shows the following:

During the year there have been produced 13,648 flasks of quicksilver, as against 9,084 flasks during the year 1874, a gain of more than fifty per cent. over the production of last year, which is due both to the greater volume of ore developed in the mine, and to its gradual increase in richness.

During the year $300,000 of the $1,000,000 second mortgage bonds have been paid off and canceled, while the cash on hand exceeds $260,000.

The net receipts for the period named were:

From sales of *13,353 flasks of quicksilver	$661,657 77
From advances on quicksilver consigned	57,600 00
From interest and discounts on deposits and purchases	3,394 66
From rents and privileges	20 241 44
From profit on materials sold	1,229 73
From wood lands, profit on wood cut	2,016 71
Total	$746,230 31
From credits to New York office for materials and supplies purchased East	2,846 50
Total net receipts	$749,076 81
Balance cash in hands of the manager, to the company's credit, December 31, 1874	15,364 99
Total	$764,441 80

The next expenditures during the year were:

For materials and supplies	$134,689 24
For mine pay-rolls	321,577 21
For Hacienda pay-rolls	57,181 23
For improvement pay-rolls	25,051 76
For miscellaneous expenses and taxes	26,539 65
For miscellaneous property	4,700 84
For wood lands	1,569 14
Total expenditures	$574,309 07
For remittances to New York office, including premiums on exchange	135,675 00
Total disbursements	$709,984 07
Balance, cash in hands of manager, to the company's credit, Dec. 31, 1875	54,457 73
Total	$764,441 80

Compared with the previous year, the net receipts, $749,076.81, exhibit a decrease of $181,966.99; the net expenditures, including remittances to New York, an increase of $7,153.78, and the sales of quicksilver reported were 13,353 flasks, of 76½ lb. each, netting $661,657.77, against $815,320.72, for 9,475 flasks sold in 1874.

The general account shows that there were on hand December 31, 1875:

Quicksilver	$34,380 00	
Ore	179,410 69	
Materials and supplies	99,375 68	$313,166 37
Cash		54,457 73
Total December 31, 1875		$367,624 10
Expended for improvements, 1875	$52,650 56	
Remitted to New York, 1875	135,675 00	188,325 56
Total		$555,949 66

The quicksilver on hand December 31, 1875, exhibits a decrease of $63,270; the ore, an increase of $20,098.60; materials and supplies, an increase of $14,374.81; cash, an increase of $39,092.74—a total net increase of assets to the amount of $10,296.15.

BALANCE SHEET DECEMBER 31, 1875.

	Dr.		Dr.
Real estate and mining property	$11,047,875 60	David Mahany, treasurer, cash and loans	$206,327 39
Convertible bond stock	71,000 00	Materials and supplies	99,375 68
Houses and lands	148,066 12	Ore account	179,410 69
Railroads	75,603 33	Quicksilver on hand	34,380 00
Furnaces	128,858 33	Miscellaneous property	8,507 49
Virginia City property	1,500 00	Woodlands	16,000 00
Furniture, Hacienda, etc.	4,000 00	Total	$12,130,909 03
Machinery and tools	55.546 67		
James B. Randol, manager, cash	54,457 73		

	Cr.	
Capital stock, preferred	$4,291,300 00	
Capital stock, common	5,708,700 00	$10,000,000 00
Second mortgage bonds		700,000 00
Income account		1,430,909 03
Total		$12,130,909 03

WIRE ROPES IN THE SCRANTON (PA.) DISTRICT.—According to the report of PATRICK BLEWITT, Esq., Inspector of Mines, there were in use in this district (which mined in 1875, 7,956,452 tons of anthracite coal) during last year, 146,664 ft. (equal 27·85 miles) of wire rope, as follows: 600 ft. of ⅝ in.; 3 840 ft. of ¾.; 700 ft. of ⅞ in.; 20,605 ft. of 1 in.; 51,814 ft. of 1⅛ in.; 61,955 ft. of 1¼ in.; 14,000 ft. of 1⅜ in.; 5,750 ft. of 1½ in.; and 600 ft. of chain. Estimating the total length of ropes in use in the anthracite districts at three times as great as the above would make over 80 miles. As many of these are of steel wire their gross value probably exceeds $200,000.

DR. FIELD'S NEW STEEL PROCESS.—The *Philadelphia Record* says: "The result of the test of the new process for making steel, which was tried at Harrisburg, Pa., a short time ago, was such as give indications of its creating an important revelation in the manufacture of steel. At the test alluded to 9,000 pounds of steel were made in the two furnaces. Nine heats were run, in four of which was placed 500 pounds of cinder pig and a like amount of MCCORMICK pig iron. As soon as this became liquid, chemicals were thrown in to separate the sulphur and phosphorus, and after this another package, which converted the iron into steel in five minutes from the time of the introduction of the chemicals. The Harrisburg *Telegraph* says: "The cost of chemicals is 64 cents per ton of steel, while the saving in iron is from 4½ to 7 per cent., while the loss in iron by the Bessemer process of converting iron into steel is very nearly 30 per cent. Such results may well attract the attention of the trade in steel rails, and it certainly would seem to put a quietus on the folly of buying any more iron rails for our railways. As one steel rail will last as long as five to seven iron rails it only remains to prove that the method of Dr. FIELDS produces a steel as reliable for wear as the Bessemer rails to settle the question of superiority to even that process. We trust whatever is yet needed in the way of test will be carefully applied to this discovery and so give the cheapest and the best rails that science can produce."

* Includes 30 flasks lost by fire in Virginia City, Nev.

SELECTED LIST OF PATENTS.

FOR THE WEEK ENDING APRIL 7, 1876.

Relating to Mining, Metallurgy, Gas Making, Engineering, etc. Reported for the "Engineering and Mining Journal" by Louis Bagger & Co., Solicitors of Patents, Washington, D. C.

174,274. Ore Concentrators, F. J. P. Pascoe, Salt Lake City, Utah.—Ore is fed upon a jigging screen, whence the coarser portions are conducted to crushing rolls, and thence successively through a rotary screen and washing pan and jiggers.

174,945. Earth Augers, J. Campbell, Door Creek, Wis.—The openings in the bucket are covered by shields controlled by the handle, being open while boring, but closing when the handle is reversed, so as to retain the earth when the auger is drawn up. Adjustable reamers are attached to the lower part of the bucket.

175,040. Gas Liquifying Pumps, J. Boyle, Houston, Texas.—Gas from the induct-pipe is freely admitted above the solid piston. The valves are supported in removable cages, and an imperfect one can be at once replaced by a new one.

175,033. Gas Furnaces, H. Call, Pittsburgh, Pa.—The products of combustion from the neck of the furnace, with the aid of a gas burner, heat the gas in uction pipe, and pass with the incoming gas into an auxiliary combustion chamber, where sufficient air is admitted to allow a low combustion to take place before final combustion over the grate.

175,068. Gas Furnaces, W. S. Gillen, Pittsburgh, Pa.—Gas is led through a pipe centrally situated in a boiler, the steam from which is driven into the furnace under the gas nozzle. The latter is furnished with cog rod and wheels, in order to make it approach and recede from the fire.

175,074. Machinery for Transmitting Motive Power, C. D. Goubet, Paris, France.—An endless chain formed of flat links with a stud at each end. A fly-wheel on the sleeve of a drum, the latter connected by a band-spring with a clutch sleeve lying around the former sleeve, the whole attachable to the shaft passing through them by the sliding of a clutch along a spline on the shaft.

175,153. Adjustable Dams for Deepening the Channels of Streams, S. Phillips, Laurel, Md.—A movable dam, extending from side to side of a stream, and of suitable height, is provided with notches or openings at its lower edge, and slides to cover them, to regulate the water currents below it. To its rear side is attached an adjustable brace and rudder. The dam is also provided with detachable and laterally adjustable sections to adapt it to different widths of streams.

175,158. Submarine Excavating Apparatus, C. Pontez, Omaha, Nebraska.—The tender slides upon a central hollow shaft, and fits with its edges over the excavating chamber. A water chamber at the upper end of the tender ballasts it, and manholes are provided through top and bottom for the workmen.

175,169.—Pile Drivers, H. F. Roehrs, Cincinnati, Ohio.—An automatic belt shifting apparatus, consisting of a worm and gear, with drum and suitable pivoted levers, and pivoted spring tripping clamps on follower head, which automatically clamp an extended endless cable, and move it sufficiently to reverse the motion of the head by shifting the driving belts. By this means the hammer is raised and dropped automatically, and it may also be tripped at any point by hand.

PRESSURE OF GAS IN COAL BEDS.—At the recent meeting of the Midland Institute of Mining Engineers a very interesting paper was placed in the hands of members "On Dislocations in the Thill, with the Presence, Amount, and Tension of Gas in the Silkstone Seam of the Strafford Main Colliery, Barnsley," by Mr. R. MILLER, the discussion on which was postponed till next meeting. The paper shows that even where no powder is used the best safety-lamps are an actual necessity to secure the safety of the workmen, and so to some extent disposes of the argument of the Home Secretary with respect to the safety-lamp itself. It appears that the first great outburst took place in the crack of the thill on October 1st, 1867, and again on August 31st, 1870, and has continued to give off gas ever since. The outburst in 1870 caused the floor to burst, there being sufficient gas to foul a strong current of air—10,000 to 12,000 ft. per minute on the face—to where it joined with 8,000 ft. per minute more for at least four hours after first coming off. A bore-hole was put down to 74½ ft., and proved as follows:—22 ft. of very hard stones—bind and gray stone—in some parts so hard as to bore only 1 ft. in six hours; 13 ft. of mild bind, with ironstone bands; down to this 35 ft. no gas was given off; 16 ft. of dark bind, with a very little gas coming off irregularly; 3 ft. very dark bind, with increased discharge of gas, and at this depth (51 ft.) went through a few inches of shale and coal, with water in the bore-hole; 20½ ft. very dark bind, with coal pipes, and with thin bands of stone. This gave no increase of gas, but gives about the same discharge from 51 feet of depth to where the bore-hole is stopped at 74½ feet down from the coal.

The hole was 2¾ in. in diameter, and a gas-pipe of 1½ in. was put down some 7 ft.; a steam-pressure gauge was put on, and in 35 minutes the gauge went up to 30 lb. the square inch, and then, after a few seconds of rending and disturbance the floor broke, and the gas spent at a crack some two yards from the hole, the gauge going back to 19 lb. This proved that the floor at not less than 11 in. depth was rent, and that it required not less than 30 lb. per square inch force to do it. Taking the thickness of 11 in., with 35 ft. thickness of hard stone, which overlay the soft measures charged with gas, suggests an almost unlimited force under that stratum so long as there was no continuous vent. A tested gas meter was then procured and the discharge was found to be 930 ft. in 88 hours, or 10½ ft. per hour. In November, 1870, the discharge of gas was 930 ft. in 88 hours, and at that time the gauge rose steadily for 50 hours until it got to 95 lb. per inch, and after having it up to 101 lb. the valve was eased so that the discharge was free. The bore-hole was about 20 yards from the working face. From the end of 1870 till June, 1873, the hole continued giving off gas with increasing quantity, which Mr. MILLER considered prevented another sudden outburst. Measured on June 11 to June 23, 1873, it was found that the hole was giving off about 50 ft. per hour, or 14,120 ft. in 283 hours. From October, 1873, to the beginning of July, 1874, a daily register was kept, but the bore-hole was sealed a part of the time, and showed pressures ranging from 80 to 117 lb. per square inch. At the end of September, 1875, the quantity of gas given off was rather over 20 ft. per hour, and at that date the faces advanced till the area of goaf was 9 a. 3 r. 22 p.

From the observations made, it appears that the pressure varied from 135 lb. per square inch down to 80 lb., whilst the highest pressure seemed to be always suddenly followed by the lowest pressure. From this it is evident that when at the highest the gas has been blown off, or has got vent in some way, and then gone down to the lowest pressure. It was suggested that in these cases of sudden outbursts the floor in some part of it may have been slightly rent and then discharge a small quantity of gas. Such might be possible, but nothing of the kind has been seen, though two sides of the goaf—the working faces and the side that is open to the return air-course—have always been watched and carefully examined. Mr. MILLER, however, says that it is more probable that when the gas has got to the gre test pressure the floor has been sprung or lifted over a certain space, making room for the gas to expand to a less force and density for the time, till the continuous discharge of more gas in time brings it up to its former power and pressure, as registered on the gauge. Though the pressure is great, there is no knowing how much greater it may become, for the extreme possible tension of gas as it is evolved from strata in the coal measures is not known as yet with certainty. This much, however, these experiments prove with undoubted certainty, that in districts where the Silkstone seam of coal is being worked with a floor such as that described at Strafford Main, and which gives off no gas in the ordinary course of working, there is a force underneath which is equal to 135 lb. per square inch above the weight of the atmosphere; and that without some tapping a release of this dangerous power either by stops in the hard floor, or by bore-holes or other means, the mine is, as it were, on the top of a heavily pressed boiler, and as the coal is worked the resisting power of the strata is reduced till an outbreak takes place. The paper, which is a most interesting and instructive one, is illustrated with several diagrams.—London *Mining Journal*.

NOTES.

LIGHT RAILS AT THE COAL MINES.—PATRICK BLEWITT, Esq., Mine Inspector, of Scranton, Penna., says that in his district (which mined in 1875, 7,956,452 tons of anthracite coal) there are at the collieries, 631,194 ft. of T rails in the mines; 230,903 ft. outside; 661,318 ft. of strap iron inside; and 68,850 ft. outside. It may be estimated that the total quantities in use in the whole anthracite district are about three times as great as the above or say total of 900 miles of track. This will probably average all round 25 lb. to the yard or say 20,000 tons of 2000 lb. The wear is very much greater than on railroads, and the length of road is constantly increasing as the mines become more extensive.

CERTAIN REMARKABLE POINTS IN MAGNETS.—M. JAM N.—If a very short magnetic needle, supported at its center of gravity, is moved near the surface of a magnet, the direction of this needle is seen to vary at the same time as the co-ordinates of its center of rotation. Among these directions there are some deserving attention, those which are normal to the surface of the magnet. The author terms the points with which they correspond, the orthogonal points, and finds that they possess the following properties:—If in an orthogonal point we place a small magnetic body, in order to remove it from its place to an infinite distance more mechanical power is required than if it had been placed on any other adjoining point of the surface of the magnet. Another curious property is as follows:—The positions of spontaneous equilibrium of a small magnetic body with relation to a magnet are exactly the orthogonal points.

EXPLOSION OF POWDER MAGAZINES AT SALT LAKE CITY.—"At five o'clock this afternoon (April 5) this city was thrown into consternation by three terrible explosions, succeeding each other at intervals of a few seconds. The people rushed into the streets in terror, horses ran away, windows were blown in, doors thrown from their hinges, chimneys blown down and many buildings badly injured. The cause of these terrible explosions was not known until an immense volume of smoke was seen rising from Arsenal Hill, immediately north of the city. Upon the hill were four powder magazines, one of WALKER BROS., for the California Powder Company, containing one and half car loads of powder; one of WALKER BROS., for the Oriental Powder Company, containing half a car load of powder; one of ZION'S Co-operative Institution for the Hazard Powder Company, containing ten tons of powder, and one of BEN JENNINGS, for the Dupont Powder Company, containing fourteen tons of powder, all of which exploded. There were no buildings very close to the magazines The water works buildings and a flouring mill on City Creek were riddled with boulders. Immense boulders fell crushing through buildings throughout the city, some falling a mile distant. Quite a number of persons were injured, and several deaths are reported. The cause of the explosion cannot be ascertained. It is stated that no men were at work on any of the magazines at the time."

STATISTICS OF COAL PRODUCTION.

This is the only Report published that gives full and accurate returns of the production of our Anthracite mines.

Comparative Statement for the week ending April 8.

Tons of 2,240 lb.	1876. Week.	1876. Year.*	1875. Week.	1875. Year.*
Wyoming Region.				
D. and H. Canal Co	57,619	432,047	52,044	699,029
D. L. and W. RR. Co.	37,220	294,727	63,867	625,658
Penn. Coal Co	17,137	239,494	27,781	278,358
L. V. RR. Co.	2,414	19,000	13,103	251,963
P. and N. Y. RR. Co.	742	5,038	2,972	10,339
C. RR. of N. J	42,780	193,054	4,009	57,196
	327,912	1,353,270	163,776	1,922,543
Lehigh Region.				
L. V. RR. Co	64,730	420,776	4,973	110,205
C. RR. of N. J.	23,918	186,018	—	5,199
D. H. and W. B. RR.	378	10,290	1,181	7,313
	89,026	617,084	6,154	123,017
Schuylkill Region.				
P. and R. R. RR. Co.	134,654	581,626	19,508	249,795
Shamokin & Lykens Val.	10,905	63,722	21,554	193,725
	145,559	645,348	41,062	443,520
Sullivan Region.				
Sul. and Erie RR. Co.	1,006	15,373	502	4,039
Total	563,503	2,631,075	211,494	2,493,119

* Year beginning January 1st.

The above table does not include the amount of coal consumed and sold at the mines, which is about seven per cent. of the whole production.

The receipts at Port Richmond for the week were 56,000 tons, shipments 35,500 tons, and balance on hand 116,650 tons.

The decrease of shipments of Cumberland Coal over the Cumberland Branch and Cumberland and Pennsylvania Railroads amounts to 31,561 tons, as compared with the corresponding period in 1875.

Perth Amboy business:

	Tons.
Received for the week	20,868
Shipped for the week	10,954
On hand April 8	89,883

The Exports of Coal from Baltimore for the week were 1,724 tons, and since Jan. 1st, 10,860 tons, as against 11,909 tons for the corresponding period of 1875.

Receipts of Coal at Boston, for week ending April 7, and years from September 1st, 1874 and 1875.

From	Week. Tons.	Previously. 1876. Tons.	1875. Tons.
Alexandria and Georgetown	440	55,064	46,896
Philadelphia	8,458	370,274	269,565
Baltimore	2,070	79,917	82,575
Other places	2,050	169,624	109,823
Great Britain	—	2,830	2,124
Nova Scotia	—	12,851	14,942

Belvidere Delaware RR. report.

	Week.	Year 1876.	Year 1875.
Receipts of coal at Coal Port (Trenton)	9,173	20,051	206
" " " South Amboy	8,269	106,703	17,196
Shipments at Coal Port (Trenton)	9,834	15,756	..
" South Amboy	7,348	99,694	87,306

The Production of Bituminous Coal for the week ending April 8, was as follows:

Tons of 2,000 lb., except where otherwise designated.

Cumberland Region, Md.	Week, Tons.	Year, Tons.
Tons of 2,240 lb	40,786	307,906
Barclay Region, Pa.		
Barclay RR., tons of 2240 lb	7,765	94,716
Broad Top Region, Pa.		
Huntingdon and Broad Top RR	3,819	40,879
*East Broad Top	827	18,660
Clearfield Region, Pa.		
*Snow Shoe	515	15,207
*Tyrone and Clearfield	10,769	252,314
Allegheny Region, Pa.		
*Pennsylvania RR	1,897	49,750
Pittsburgh Region, Pa.		
*West Penn. RR	3,016	57,482
*Southwest Penn. RR	439	15,433
*Penn. & Westmoreland gas coal, Pa. RR.	10,483	160,682
*Pennsylvania RR	2,368	93,118

* For three days ending March 31.

The Production of Coke for three days ending March 31.

Tons of 2000 lb.	Week. Tons.	Year. Tons.
Tyrone and Clearfield	..	..
Alleghany Region	..	..
West Penn. RR	979	12,190
Southwest Penn. RR	9,333	108,177
Penn. & Westmoreland Region, Penn. RR.	497	8,175
Pittsburgh, Penn. RR	3,138	54,381
Total	13,947	182,923

COAL TRADE REVIEW.

NEW YORK, Friday Evening, April 14, 1876.

Anthracite.

Some dealers report an improving business, but, on the whole, trade is exceedingly dull and stocks are so rapidly accumulating that a large curtailment of production next month seems inevitable. This, of itself, in view of the great depression existing in nearly all branches of business, would not be so ominous a sign; but it is very generally believed, and in some cases known, that prices are being cut to a very great extent. Were this the case at a time when the bulk of the year's business had been done, it would not cause much comment; but, occurring as it does, within two weeks after making contracts for the year's business, it argurs ill for a maintenance of the Combination during the whole season. To maintain prices it will be necessary to limit the output to such an extent that the demand will readily take up all coal mined. If a surplus be sent to market there are parties who *will sell* their proportion of it, and, if they cannot get the established rates, will take such as they can get. This would, necessarily, result in demoralizing the trade, and, finally, in breaking up the Combination. We shall not, at this early day, prophesy such a result, but it is very evident that if prompt means be not taken to insure a practical compliance with the *spirit* of the published programme, the approaching dissolution of the Combination cannot be doubted. We have, however, had so many indications of weakness, followed by meetings in which "the greatest harmony" was reported as existing, and assurance given that the Combination was "stronger than ever," that our readers should not attribute too much importance to the rumors of the Combination being unstable, although at present there is no denying that the indications are in favor of discreet buyers getting their coal during the season considerably under the established rates.

Our readers know that the ENGINEERING AND MINING JOURNAL has always taken a position of strict independence, criticizing freely, but never unfairly, the management of the Combination where we considered it opposed to the best interests of the trade and of the country at large. We have, sometimes, pointed out what we considered serious errors in judgment, and have denounced what we considered bad faith in the carrying out of obligations towards the public or the trade. A powerful trade combination like this generally requires some check and not a little watching, or, as with every other human government, unlimited power would lead to tyranny and oppression.

Probably the highest compliment we could pay the managers of the associated companies is that, as a result of this somewhat close supervision, we have no hesitation in saying that the Combination has been of incalculable benefit to the coal trade, and of considerable advantage to manufacturing industries generally during the past three years. Without it the coal mining industry of the country would have been thoroughly disorganized, and millions of capital would have been sacrificed without any compensating advantage. It has stood between the coal trade and bankruptcy; and now that the ebbing tide of our business depression has reached, as we hope, its very lowest point, and that we may look for the returning flood, it would, indeed, be unfortunate if the wisdom, that has, up to this point, maintained the Combination, should fail.

It is impossible to frame any agreement between the great companies, that will altogether prevent those "tricks of the trade" that are looked upon by some as indications of a laudible "smartness," but which should be classed with the disreputable practices of "sharps." That honest, loyal good faith, which respects the spirit of an agreement and shows itself in fair dealing and loyalty, is the only guarantee for permanency in a coal Combination as for ultimate success in any other undertaking, and though this quality is fully recognized as guiding the leading spirits in this association of companies, there are facts which would indicate its absence as a controlling power among some of the subordinates in the Combination. Shall these be allowed to break up an agreement which alone stands between many large enterprises and financial ruin, is now the all-important question.

The failure of the Combination, followed as it would be by the "slaughter" of coal, and the ruin of many of those engaged in the industry, while it might be a temporary advantage to some consumers, would work irreparable injury to the mining regions generally, and to the thousands who are dependent directly or indirectly for their means of living on the prosperity of the coal trade.

Bituminous.

The business doing in this class of coal is confined to a regular trade, and no important new contracts are reported.

The center of attraction is the Cumberland field. The most favorable item of news from that section, is the announcement of a reduction of 5 cents per ton in coal tolls on the Chesapeake and Ohio Canal—the new rate being 46 cents for tolls and wharfage. The next favorable item was that the Consolidation Company had joined in the movement to reduce wages, but this was followed by an announcement that, owing to several other companies continuing to pay the old rates, no reduction would be insisted upon by this company. Such other companies as had announced a reduction of wages still insist upon it. A very peaceable meeting of the miners took place at Lonaconing on the 10th inst. Most of the representatives who addressed the meeting were in favor of striking, although there were some who expressed the belief that their time had come, to submit to a reduction of wages, a thing inevitable in these times of general shrinkage in values.

The Cumberland *News*, of April 10, says: "On Saturday afternoon, April 8, it transpired that the Consolidation Coal Company had become the purchasers of the Cumberland and Pennsylvania Railroad, and that the latter would hereafter be operated as the property of the former under the title of the 'Cumberland and Piedmont Railroad.' The sale was effected, we are informed, early in last month, but so far the papers have not been filed in the county clerk's office, as will be required to be done.

"With the above information came the announcement of the rate charged by the railroad in question for the transportation of coal. Bills were rendered at the rate formerly charged by the Cumberland and Pennsylvania Railroad, and consequently in excess of that set by the recent act of the Legislature."

This action was anticipated last week, as intimated by us in our stock report, and is supposed to have given buoyancy to the stock of the company in this market. There is already talk of a special meeting of the Legislature to prevent this evasion of the law. There are also rumors of certain irregularities in the charter of the Consolidation Company, which, if proven, are likely to place matters in a much worse position for the company than if it had submitted with good grace to the reduction in freights imposed upon it by the Legislature. This evident effort to evade the law, which called for a moderate, just, and much needed reduction in freight rates, is almost everywhere looked upon as "tricky," "sharp practice," and, if we are not much mistaken, will recoil, as is usual with such policy, on those who adopt it.

Coal Trade of Philadelphia.

PHILADELPHIA, April 13, 1876.

Coal matters here look very bad. The company is so blocked with coal at their wharves and with loaded cars, that the supply to the collieries is very unreliable, and decreasing every day. A curtailment of 25 per cent. to

tide water, as agreed by the Combination, would be cheerfully submitted to. That a curtailment was necessary this month is acknowledged by every body, but there is a wide difference between that sensible move, and the reckless way by which parties doing business over the Reading are deprived of the means of carrying on their contracts, and filling their orders. The curtailment has reached as high as 60 per cent. It is difficult to make this short supply of cars agree with the return of the company, which is 150,578.02 tons for last week, or within 30,000 to 40,000 tons of the fullest average shipment while everybody had all the cars they could load. The company is not blocked with all sizes. Egg and stove are the troublesome ones, and this is caused in two ways—they were full of those sizes when they started, and they are receiving now more than a fair proportion of them, as they pay a high price for stove, and a poor one for other sizes. To have a trade, enlarge it and give the road large receipts for transportation, should be the main aim of the company, but it is only of secondary importance to them. It would almost seem as if all their wit was concentrated on devising how to kill some body who brings them trade, in order to get everything themselves, and they are now caught in their own trap. Amongst their many former friends, numbers illustrate now the old fable of the ass kicking the sick lion. Trade would be beginning to move better, with a fair prospect of a steady improvement until May, when it is expected that for a couple of months at least, there will be a fair activity, to be renewed again in the fall, but this blockade with sizes not needed, and no possible relief at an early period—for it is getting worse every day—is very discouraging, and causes this port to lose a considerable amount of trade. It took forty years to build up the anthracite coal trade here, and it looks as if it would take considerably less to kill it.

Freights are $1.35 to Boston and Portland, 75c. to Washington, and low in proportion to all points. There are orders enough in the market to cause higher rates if parties having orders were allowed to ship them.

Wholesale Prices of Anthracite Coal for April, f.o.b. at the Tide Water Shipping Ports per ton of 2240 lb.

	Lump.	Steamer.	Grate.	Egg.	Stove.	Chestnut.
Wyoming Coals.						
‡Lackawanna and Scranton at Hoboken and Weehawken	4 60	4 70	4 80	4 90	5 50	4 70
Pittston at Newburg	4 45	4 55	4 65	4 75	5 35	4 55
Wilkesbarre at Port Johnston	4 60	4 70	4 80	4 90	5 50	4 70
Plymouth, R. A.	....	....	4 80	5 00	5 60	4 80
Susque. Coal Co. at Amboy W.A.	4 60	4 70	4 80	5 00	5 50	4 80
Kingston at Hoboken	4 60	4 70	4 80	4 90	5 50	4 70
Lehigh Coals.						
Old Company at Port Johnston	5 10	....	4 90	4 90	5 50	4 80
Old Company's Room Run "	5 10	....	4 90	4 90	5 50	4 80
§Sugar Loaf, Hobok. &Amb."	5 10	....	4 90	4 90	5 50	4 80
Lehigh Coal Exchange "	5 10	....	4 90	4 90	5 50	4 80
Honey Brook Lehigh	5 10	....	4 90	4 90	5 50	4 80
Beaver Meadow at South Amboy	5 10	....	4 90	4 90	5 50	4 80
Schuylkill Coals at North 9th st., Brooklyn, E. D.†						
Schuylkill white ash	4 60	4 70	4 80	4 90	5 50	4 70
Schuylkill red ash	....	....	....	5 00	5 60	4 70
Shamokin white and red ash	....	....	....	5 00	5 60	4 70
Lorberry	....	....	5 70	5 70	5 70	4 75
Lykens Valley	....	....	6 10	6 10	6 10	5 20

* Contractor's prices are 20c. per ton less.

†The prices of Schuylkill coals for shipment from Philadelphia are 35c. per ton less than at Brooklyn.

‡ Boats towed by the D. & H. C. Co. at its expense to and from New York harbor.

	Per ton.
Freight from Hoboken and Weehawken to New York	35@40c.
" " Elizabethport & Port Johnston to N. York.	40c.
" " South Amboy to New York	40c.

Freight by the boats of the companies from Hoboken, Port Johnston, Weehawken, Rondout, South Amboy and Perth Amboy to New York City and vicinity 50c.

Freight by the Pennsylvania Coal Company's boats from Newburg to New York 65c.

Wholesale Prices of Bituminous Coal.

Domestic Gas Coals.

Per ton of 2240 lb.	At the Shipping Ports.	Alongside in NewYork.
Westmoreland and Penn. at Greenwich, Philadelphia	$4 70	$6 00
" " at S. Amboy	5 50	6 00
Red Bank Cannel Pa. at Philadelphia	8 00	8 50
" " South Amboy	8 50	...
" Orrel	6 00	6 50
Youghiogheny, Waverly Co., at Balt	4 25	5 75
Despard, West Va.	4 50	6 00
Murphy Run, West Va., at Baltimore	4 50	6 00
Fairmount, West Va., " "	4 50	6 00
Newburgh Orrel, Md. " "	4 50	6 00
Cannelton Cannel, W. Va.	....	10 00
" Splint, " at Richmond.	4 50	6 00
Peytona Cannel, " "	8 50	10 00

Manufacturing and Steam Coals.

Cumberland, at Georgetown and Alexandria, Va	3 65@3 75	5 00
Cumberland, at Baltimore	3 90@4 00	5 25

Kittanning f.o.b. Canton, Baltimore..4 25@4 35

Rockhill Semi-Bituminous and Broad Top, at the mine, per 2,000 lb., 90, f. o. b. Greenwich, Philadelphia, per 2240 lb, 3 70@3 95, according to destination; at Amboy, 4 65@4 90; New York, 5 10@5 25.

Clearfield and Allegheny, "Kittanning," "Sterling," "Sonman," and "Eureka," at the mines, per 2000 lb., 90; at Greenwich, Phil., per 2240 lb., 3 90, 4 00, 4 25, and 4 50, according to destination; f. o. b. South Amboy, N. J., 4 70@5 00; New York, 5 25@5 50.

Foreign Gas Coals.

	Sterling.	Am. cur'cy,
Newcastle, at Newcastle-on-Tyne	9/6@11/	6 50@7 00
Liverpool House Orrel, at Liverpool	26/	13 00
Ince Hall Cannel "	42/	18 00
" Gas Cannel "	28/	13@14
Scotch Gas Cannel, at Glasgow, nominal,	25/	7 50
	Gold.	
Block House, at Cow Bay, N. S.	2 00	5 00
Caledonia, at Port Caledonia	1 50	4 75
Glace Bay, at Glace Bay	1 50	4 75
Lingan, at Lingan Bay	1 75	....
Sydney, International and Reserve mines, at Sydney	2 00	5 50
Pictou, Albion & Vale mines, at Picton.	2 25	5 75

Retail Prices in New York.

Anthracite

Per 2000 lb.	Grate and Egg.	Stove.	Chestnut.
Pittston coal, in yard	$5 70	$6 00	$5 30
Lackawanna coal, delivered	6 25	6 75	5 75
Wilkes-Barre, "	6 25	6 75	5 75
Lehigh & Locust Mountain, del'd..	6 00	7 00	6 00
Schuylkill Red Ash, del'd	7 50	7 50	6 00

Our retail quotations of Pittston Coal are based on the actual selling rates of the company, nominal quotations of grate and stove are 20c., and of nut 30c. per ton above these rates. The Cost of delivery ranges from 40 cts. to $1 10 per ton, according to distance from the yard.

Bituminous.

Liverpool House Orrel, delivered, per ton of 2000 lb	$18 00
Liverpool House Cannel " " "	†22 00
American " " " "	13 00
Kanawha splint, " " "	12 00
American Orrel " " "	11@14
Red Bank Cannel " " "	14 00
Cumberland " " "	7 00

† This quotation is furnished to us by Messrs. WARD, TALBOT & OLYPHANT.

Baltimore, Md. April 8, 1876.

Reported by our Special Correspondent.

ANTHRACITE.

Wholesale or Trade Prices per 2240 lb.

Wilkes-Barre "Lee" or "Diamond," *Pittston and Plymouth.*	In cars at depot.	By boats afloat.
Lump and steamboat	$4 62	$4 47
Broken	5 21	5 06
Egg	5 35	5 20
Stove	5 51	5 36
Nut	4 66	4 51
Shamokin. (red or white ash), and "Boston," free burning white ash,		
Egg	5 35	5 18
Stove	5 50	5 43
Lykens Valley, red ash,		
All sizes	6 05	6 68

From wharf or yard, wholesale, 50@75c. additional.

By retail, all kinds and sizes, per 2240 lb.

BITUMINOUS.

George's Creek and Cumberland f. o. b. at Locust Point	4 00
West Virginia f. o. b. at Locust Point	4 50
Youghiogheny Gas, f. o. b. at Locust Point	4 50
Swanton Coal, George's Creek	4 00

Boston. April 8, 1876.

The anthracite market has sloped into the most disconsolate condition, and stands in a quagmire of doubt and disgust. In response to the beckonings of the combination the trade have got in their bids or orders under the expectation that a regular monthly advance would be made, but which is now announced as likely to occur only on the consumers' or No. 1 circular prices, and here only at the rate of 5c. per ton. Hardly a dealer but has magnified his wants to four times what they actually will be, the intention being to take advantage of the freight market and order shipped all their coals at a moment when skippers are weak, and a chance to shade a freightage is obtainable.

For instance, A sells 10,000 tons a year; he orders 40,000 or 50,000, knowing he is not obliged, if the oral statements of the combination agents are reliable, to take a single ton. If freights should sag down 10c. a ton, A would at once order one-fourth of his contract shipped, which would in reality be all he would want. The exact animus of this Micawbering principle in contracts is not explainable, other than it may be amusing to stockholders at the end of the year to have read off the immense contracts they could not fill. The little dodge would be very valuable as a carrying companies' stock bulling operation, a sort of semi-authoritative basis on which to figure the probable business for the year, and so tickle somebody with anticipatory dividends on this immense carrying trade visible.

So pleasant a programme ought certainly to please everybody, but it doesn't, for the reason that few dealers have been informed that their contracts will be accepted if so wished while a few others have been put off with only half what they figuratively asked for, and others are yet undecided upon. Added to this, one concern's coal is selling at 5c. and 8c. a ton less than the combination's lowest prices, while a mixture of brands of stove sizes which the consumer is likely to know nothing about is —well it was possibly the basis for the 50c. a ton break in the retail yards early in March, and will possibly be full of similar mischief by an by.

The Philadelphia ship owners and masters' association are receiving contracts for unloading all their vessels; and the possibility is that one stevedore will take the contract for the whole New England coast. The thing seems full of difficulties at the outset, but is quite as feasible as the new bill of lading introduced two years ago, and will, if once under way, be very satisfactory to the trade. The price will likely not exceed 20c. all charges, and not improbably go down to 15c. or 18c. A large cargo has been delivered in this city within a month at 12½c. and then much quicker and better than by the regular gangs.

This rumor that each Reading steamer would bring its own shoveling crew at $1.50 a day, and found is credited. In this connection are the gossipy facts that a leading shoveling gang of eight in this city have been paid the past year $1,484. 60 each man. The foreign steamer which Wellington recently discharged cost $80 for shovelers. He could have put 20 men in the hold at $3 a day, and saved $20 cash. 20 shovelfuls fill a bucket, and it wouldn't have been very hard work for the men.

The gossip over the contract of the city for its 1,000 tons at the East Boston Ferry is full of the suggestions of what luck will do. The contracts for the city institutes have been made all on bids for the coal delivered, the Gas coal at $5.55 a ton, the Cumberland at $5.17, and the Anthracite for steamboat broken at $5.55½. As the delivery requires a draft of 8 feet only, the prices, it will be seen, are very low.

The prices for Bituminous are unchanged from those last reported.

Freights are a trifle stiffer, New York charters are firm at $1. Philadelphia $1.40@1.50, Baltimore to Boston $1.60, and Georgetown to Providence $1.50.—*Commercial Bulletin.*

Buffalo, N. Y. April 10, 1876.

Reported by our Special Correspondent.

ANTHRACITE.

	Afloat. f.o.b.	Retail, Deliv'd.
Grate	$6 40	$7 40
Egg	6 40	7 40
Stove	6 85	7 85
Nut	6 60	7 60

	Lump.	Run of Mine.	Nut.	Slack.	Nut & Slack.
Connellsville Coke	$5 15	....	....	....	....
Brookfield Coal	4 25	...	....	....	....
Briar Hill	4 25	....	2 80	....	....
Youghiogheny	4 50	....	....	....	....
Monterey	3 30	3 25	....	2 30	....
Catfish	3 30	3 25	....	2 30	....
Stoneboro	...	Bk'n	....	2 30	....
Cannel	5 50	4 75	4 50	....	....
Cameron	3 50	3 00	....	2 30	....
Reynoldsville	3 65	3 50	3 00	2 30	....

Chicago, Ill. April 11, 1876.

Specially reported by Messrs. RENO & LITTLE, Coal Merchants.

Retail prices per ton of 2000 lb. delivered to buyer.

No change.

BITUMINOUS.

Lehigh Lump	$10 50	Briar Hill and Erie	@ 6 00
Lehigh grate and egg	10 50	Walnut Hill, Pa.	@ 6 50
Lehigh stove and chest.	11 00	Midway, Pa.	@ 6 50
Lackawanna, Wilkes Barre and Pittston*		Cannel	@ 8 00
		Blossburg	7 50
Grate and egg	9 50	Indiana Block	6 00
Stove and chestnut	10 00	Hocking "Brooks"	6 50
		Wilmington and Illinois.	5 00

* 50 cents off these prices for car load lots to country dealers and manufacturers.

Cincinnati, O. April 13, 1876.

Reported by our Special Correspondents.

Trade quiet. Coal continues to arrive almost daily, without much effect on prices. Following are the quotations:

Per ton of 2000 lb.	Bush.	Ton.
Youghiogheny, or Pittsburgh, afloat	7¾@8c.	——
Pomeroy coal "	5½@6c.	——
Kanawha "	7½c.	——
Cannel coal, according to quality "	18 c.	——
The following are the retail prices delivered		——
Youghiogheny	10c.	——
Pomeroy	9c.	——
Cannel	22c.	——
Kanawha Semi-Cannel	10c.	——
Anthracite, per ton	10 50@11 00	——
Coke, at yard	7c.	——
Coke, hard and soft, delivered	9c.	——

Erie, Pa. April 10, 1876.

Wholesale, per ton of 2000 lb. Bituminous f. o. b.

Briar Hill lump	$3 75	Beaver lump	$3 50
Midway	3 25	Cat Fish	3 00

Milwaukee, Wis. April 10, 1876.

Specially reported by Messrs. R. P. ELMORE & Co.

Our market in coal remains unchanged with but little demand. Prices remain the same.

Retail price per ton of 2000 lb.

Lehigh Lump	$10 00	Briar Hill, select	$8 00
Lehigh Prepared	11 00	Blossburgh	8 00
Lackawanna (all sizes)	10 00	Cannel	8 00
Pittston	10 00	Pittsburgh	7 00
Scranton	10 00	Steam coal	5 00

New Orleans, La. April 8, 1876.

Reported by C. A. MILTENBERGER & Co.

We can report a slight advance on wholesale rates since our last, while retail prices remain unchanged. Stock small, but an abundance of coal may be anticipated during this and next month. We quote:

Pittsburgh coal, retail, per bbl	30c.
" wholesale	50c.
" steamboats, per box	50c.
" to manufacturers, per bbl	50c.
" shipments, per hhd	$6 00
Anthracite, wholesale, per ton	....
" retail, "	12 50
Virginia Cannel, per bbl	80c.
Scotch " "	80c.
Mt. Carbon, wholesale, per bbl	...
" " retail, "	55c.
St. Bernard wholesale, per bbl	....
" retail, "	50c.

Richmond, Va. April 10, 1876.

Specially reported by S. H. HAWES, Dealer in Coal.

Per ton of 2240 lb., f.o.b.

Kanawha Cannel	$9 00	New River Bituminous,	$4 50
" semi-Cannel	4 75	Clover Hill Coal	4 00
Coalburgh Splint	4 75	James River Bitum	3 30
Lewiston "	4 75	" " Carbonite,	5 80
Kanawha Gas coal	4 50		

San Francisco, Cal.

From the *Commercial Herald*, March 30, 1876.

Imports from Jan. 1st to March 1st:

	tons.		tons.
Anthracite	4,139	English	5,502
Australian	11,823	Vancouver Island	10,657
Coos Bay	7,520	Rocky Mountain	64
Cumberland	2,044	Seattle	12,854
Mt. Diablo	17,700	Bellingham Bay	3,175

The market is fully supplied with nearly all descriptions and prices steady. Imports for the week embrace

the following cargoes: *Shooting Star*, Nanaimo, 680 tons; *Frank Austin*, same, 850 tons; *Sonoma*, Departure Bay, V. I., 1575 tons Wellington; *Discovery*, 375 tons Seattle; *Freedom*, New York 359 tons; *D. H. Deitz*, Philadelphia, 704 tons, etc. The Pacific Mail Company are large buyers and consumers of Seattle bituminous coal. The mines of Vancouver Island are being worked freely and their product steadily increased. The Wellington is a growing household favorite, and by some preferred to all other kinds. Nanaimo is largely used by the Gas Company. We continue to quote Australian, $10@10 25 ex ship. Supplies of Cumberland are well controlled, and in casks held at $22; bulk, $18. Lehigh is plentiful and prices nominal. We quote Bellingham Bay at $8.50; Coos Bay, $10; California Mount Diablo Steam, $6.25@$8.25 for fine and coarse respectively; English and Scotch Steam, $9@9.50; Nanaimo, $9.50@$10; Seattle, $9.50@$10; Anthracite, $12@$15; Lehigh, $14@$15; Wellington, $11@$12, latter screened.

Toledo, Ohio. April 10, 1876.

Specially reported by Messrs. GOSLINE & BARBOUR.

We quote coal as follows:

Per ton of 2000 lb. on cars.

Hocking Valley	$3 40	Massillon	3 60
Straitsville	3 40	Youghiogheny	5 00
Shawnee	3 40	Blossburg	6 50@7 00
" nut	2 90	Cumberland	6 50@7 00
Briar Hill	5 50	Connellsville coke	6 40

ANTHRACITE.

Grate, screened	$7 20	Stove, screened	$7 70
Egg, "	7 20	Chestnut "	7 45
Lehigh Lump	9 50		

40 cents to $1 per ton additional for delivery at retail.

Halifax, N. S. April 10, 1876.

Prices per ton of 2240 lb. in gold.

Sydney (old mines)	$4 00	Little Glace Bay	3 35
Gowrie	3 35	Blockhouse	2 35
Victoria	——	Albion (at Railroad)	4 00

Montreal. April 10, 1876.

Specially reported by Messrs. ROBERT C. ADAMS & Co.

Wholesale per ton of 2240 lb.

Scotch Steam	$6 00	Cape Breton Steam	$5 25
Pictou "	5 75	Newcastle Smiths	7 50

Anthracite at retail, per 2000 lb., delivered.

Egg	$3 50	Chestnut	8 50
Stove	9 50		

Toronto, Ont. April 10, 1876.

Chestnut	$7 25
Stove	7 50
Egg and grate	7 25
Bituminous coal for domestic use	6 00
" " steam	3 50@5 50
Lehigh Lump and broken	7 50
Blossburgh	6 50

Rates of Transportation on Anthracite Coal to Tide Ports.

Lehigh and Wyoming Coals. per ton of 2240 lb.	From Penn Haven.	From Mauch Chunk.	From Hazleton**	From Upper Lehigh.	From Ashley and Sugar Notch
To ‡ Newark, N. J. (117 miles), via Central Railroad of New Jersey	2 30	2 16	2 74	2 63	2 86
‡ Mauch Chunk, Pa., via Central Railroad of N. J.	14	..	56	47	70
‡ Philipsburg, N. J., (46 miles)	86	72	1 21	1 19	1 42
Elizabethp't, (114 m.) Pt. Johns., Hoboken & South Amboy, N. J., shipping and wharfage 35c. add.	1 94	1 80	2 29	2 27	2 50
High Bridge, N. J.	2 40	1 95	2 80	2 54	2 72
Elizabeth, Cranford, Westfield & Elizabethport, for consumption,	2 30	2 16	2 63	2 63	2 86
Jersey City, N. J., (121 miles) and New York, via L. V. RR	2 30	2 16	2 63	2 63	2 86
Andover, via Delaware, Lackawanna and Western RR	3 30	3 10	3 70	3 69	3 99
Trenton Somerset Junction and Greensburg, via P. RR. Belvidere Division	2 65	2 45	3 05	3 04	3 34
Trenton, (97 m.) for shipment, including shipping and wharfage	2 11	1 95	2 45	2 46	2 76

From *Mauch Chunk* to *New York* (121 miles), (towing limits) and Jersey City† via Lehigh Valley RR. $2 37

From *Mauch Chunk* to *Philadelphia* (93 m.) via L. V. and L. and S. RR. and North Penn. RR 1 75

††From *Phillipsburg, N. J.* to *Hoboken* (84 m.) for shipment via Delaware Lackawanna and Western RR., Morris and Essex Division 1 08

From *Lackawanna Junction* to **Auburn, N. Y.*, (191 m.) for shipment, via Southern Central R R. in connection with Pa. and N. Y. R.R. 2 53

From *Lackawanna Junction* to *Weedsport* (201 m.), for *Rochester and Charlotte* 2 59

From *Lackawanno Junction* to *Sterling* for *Oswego, N. Y.*. 2 62

‖ To this point for all places between Rochester and Buffalo the rate is 2 53

* The rate to this point for Syracuse is 2 08

** Rates on line coal from Hazleton are 10c. per ton above these figures.

‡ The cost of unloading is to be added to these rates. No charge less than 40c. per ton will be made for any distance. Tolls from Mauch Chunk to Phillipsburg for way points will be $1 15 per ton.

§ Twenty cents per ton less when five cars at a time to one party. Provided that where the reduction makes the rate $1 a ton, or less, the rate will be $1.

† Transportation on Coal destined for re shipment from this point is 20c. less than above rate.

†† The rate for consumption to this point is $1 80.

The distances in the above table are Computed from *Mauch Chunk*. From *Ashley* to *Mauch Chunk* the distance is 51 miles, and from *upper Lehigh*, 33 miles. From *Hazleton* 24 miles, and from *Penn Haven* 8 miles.

From *Wilkes-Barre* to *Perth Amboy* via the Lehigh Valley Railroad Company, the distance is 161 miles, and from *Mauch Chunk* it amounts to 106 miles.

Freights on Bituminous Coals from the Mines to Tide Water Shipping Ports.

From the Mines to Cumberland and State Line (say an average of 20 miles), the legal charge is 2 cents per ton of 2240 lb. per mile.

From State Line to Amboy (346 miles) $4 per ton of 2000 lb. On coal shipped beyond this point there is a drawback of 75 cents per net ton.

From Cumberland to Baltimore (178 miles) $2.02 per ton of 2240 lb., or $1.80 per net ton (¼ cent per ton per mile for use of hoppers over C. & P. RR.).

From Cumberland to Georgetown (152 miles) by canal, $1.10. Tolls, 46 cents.

From the Mines to Piedmont, 4 cents per ton of 2240 lb. per mile on distances less than 4 miles, and 3 cents per ton per mile on distances over 4 miles, and 2 cents per ton per mile on distances over 10 miles.

From Piedmont to Baltimore (206 miles) $2.41 per ton of 2240 lb., or $2 15 per net ton.

From Osceola to Greenwich, Phila. (say 248 miles) per T. & C. RR., per ton bituminous coal of 2000 lb., less drawback of $1.46 $2.15; rate per gross ton, $2.60.

From Osceola to South Amboy, N.J., (317 miles) per 2000 lb., $4.03, less drawback, $1.03; rate per net ton, $3; add 12 per cent for gross ton, 36 cents, terminal expenses, shipping, 20 cents; rate per gross ton, $3.56.

Freights.

Per ton of 2240 lb.

PORTS.	From Philadelphia.	From Baltimore.	From Georgetown.	From Elizabethport, Port Johnson, South Amboy, Hoboken and Weehawken.
Augusta, Me.	....	....	....	....
Albany	†80	...	...	....
Amesbury, Mass.	....	....	....	....
Bangor, Me.	....	....	....	1 00
Bath, Me.	....	1 50	150–55	1 00
Baltimore	....	....	....	....
Boston, Mass.	1 35@1 50	1 45	150–55	1 00
Bridgeport, Ct.	*70	1 40	....	70
Bristol, R. I.	....	....	....	85
Cambridgeport, Mass.	§1 40@1 55	....	...	1 00
Derby	....	....	....	....
Dighton	....	....	....	....
East Cambridge	§1 35@1 50	....	....	§1 00
Fall River	1 25	1 40	....	85
Hackensack	*70	....	....	....
Hallowell, Me.	....	....	....	....
Hartford	*70	....	....	....
Hoboken	†70	1 20	1 25	40
Hudson	....	1 20	....	....
Jersey City	70	1 20	1 25	40
Lynn, Mass.	....	....	....	†1 00
Middletown	....	....	....	1 00
Mystic	....	....	....	....
Newark	....	1 50	....	....
New Bedford	1 30	1 40	....	85
Newburyport	....	1 10	....	1 10
New Haven	*70	1 40	1 30	60
New London	1 25	1 40	....	80
Newport	1 25	....	....	85
New York	70†	1 20	1 25	40
Norwalk	70‡	1 40	....	60
Norwich	1 25‖	....	....	80
Pawtucket	1 75‖	....	....	....
Philadelphia	....	....	....	....
Portland	1 30	1 40	....	1 00
Portsmouth, N. H.	1 30@1 40	1 60	....	1 10
Providence	1 25	1 40	....	85
Poughkeepsie, N. Y.	....	....	....	....
Rockport	....	....	....	....
Saco	....	....	....	....
Sag Harbor	....	....	....	1 00
Salem, Mass.	1 25@1 35	1 50	....	1 00
Salisbury Pt., Mass.	....	....	....	....
Stamford	*70	....	....	60
Stonington	....	....	....	....
Taunton	....	....	....	....
Troy	†30	....	....	....
Warren, R. I.	....	....	....	85
Wareham	....	....	....	....
ymouth	....	....	....	....

* And discharging and towing. † And discharging. ‡ And towing. § 3c. per bridge extra.

Towing.

Rates of Towing from New York to places on the *Hudson River*. Boats of 175 tons capacity and upwards. Per ton of 2240 lb.

	cts.		cts.
Yonkers	9	West Point & Cold Spring	17
Piermont & Dobbs' Ferry	12	Poughkeepsie	20
Nyack & Sing Sing	15	Rondout	23
Peekskill & Haverstraw	16	Hudson	25

Rates for boats of 100 tons, per boat, are as follows:

	cts.		cts.
Manhattanville	10	Sing Sing & Peekskill	20
Yonkers	15	Newburg	25
Tarrytown	18	Poughkeepsie	30

Special Rates will be made for Saugerties and Catskill.

East River, from the foot of Twenty-third street, to the following points, *and return*, per ton:

	cts.		cts.
New Haven & Norwalk	33	Middletown	65
Southport and Milford	35	Norwich	67
Branford	45	Hartford and Mystic	75
New London	60	Stonington	75

Derby 33 cts. per ton and $50 per boat extra.

Bristol, Fall River, Providence, New Bedford, *Special rates*.

Boats having less than 200 tons, will be charged the same as if carrying that quantity.

* Rates of Towing from foot of 23d Street, E.R., to the following points.

Boats upwards of 150 tons capacity.

	cts.		cts.
79th street 93d st. and Astoria and return*	$12	New Rochelle and Glen Cove	$45
Mott Haven and Harlem†	16	Mamaroneck and Portchester	60
Flushing and Whitestone‡	25	Greenwich and Darien	70
Little Neck and Port Washington	40	Round trip to Port Johnston	14
College Point and Bowery Bay	25	Round trip to Elizabethport	20

From Hoboken to Limits (53d Street, E. R.). $5; N. R., $5.

Other Towing in the vicinity of New York, special rates:

* Small boats (less than 150 tons) to these points $10

† " " " " " " " " 14

‡ " " " " " " " " 20

Rates via the Hudson River are furnished to us by A. B. VALENTINE, No. 41 Jay Street. Rates via the East River are furnished by W. E. GLADWISH, No. 12 South Street.

*These rates are furnished to us by DAVID COX, 89 West St.

IRON MARKET REVIEW.

New York.

FRIDAY EVENING, April 14, 1876.

American Pig.—There is a certain amount of business doing in a small way, but at what prices it is difficult to say. Some companies claim to be holding No. 1 foundry at $23, but we do not believe that any business is being done at that figure. $21@$21.50 are very freely mentioned, while there are rumors of a sale at $20, although we are unable to confirm this. There is a rumor of sales for season delivery of 4,000 to 5,000 tons of forge iron to go East. This also lacks confirmation. We quote No. 1 foundry at $22; No. 2 at $20; and forge at $19. Strenuous efforts are being made to have the price of coal and freights reduced. We have, for a long time, advocated these reductions, thinking that when concessions were being made to general buyers of coal, some reduction should be made to furnace companies. Although the price of coal in market is too high, yet there is not room for a great reduction in this article at the mines. The great item of overcharge on everything connected with the iron trade is in freights, which should be reduced to such an extent as to make the cost of pig iron delivered in market several dollars per ton less than it is now. If the transportation companies continue to charge exorbitant rates they will ruin a business which is one of their chief sources of profit. It is very likely that many furnaces in blast at the present time will be compelled to blow out, while there are none that will blow in until there is some margin of profit. Lower prices and a bottom must be reached, and the quicker this is done the better for both transportation companies and ironmasters.

Scotch Pig.—This article continues very steady under a quiet demand, which is sufficient to take up the small importations and prevent iron going into store. We note a sale of 300 tons of Egliuton, in bond, at a private gold price, for export to St. Johns, N. B. We quote Eglinton at $28.50@$29; Glengarnock, $30@$30.50; Coltness, $32; and Gartsherrie, $31.50.

From the circular of Messrs. JOHN E. SWAN & BROS., Limited, dated Glasgow, March 31, 1876, we extract the following: "The number of furnaces in blast were 118 as against 123 a year previous; the stock of iron in CONNAL & Co.'s stores was 62,484 tons, a decrease of 120 tons during the week; the shipments for the week ending March 25, were 8,984 tons, a decrease of 1,341 tons as compared with the corresponding week in 1875; the total shipments from Dec. 25, 1875, were 87,657 tons, a decrease of 23,621 tons as compared with the corresponding period in 1874-5. The quotations of No. 1 pigiron were as follows: Gartsherrie, 68/; Coltness, 69/; Summerlee, 66/ 6d.; Glengarnock, 65/ 6d.; Eglinton, 58/ 6d. Freights were quoted as follows: To New York, 2/ 6 d.; Boston 9/; New Orleans, 5/; Baltimore, 8/; Philadelphia, 10/; San Francisco, 27/ 6 d."

Rails.—We are reported a sale of 2,000 tons of iron rails, particulars not given. Prices remain without change at $40@$43 for iron rails at mills, and $60@$63 for steel.

Old Rails.—The general asking price is $23, although we are reported a sale of 100 tons at a lower figure,

Scrap is very quiet and nominally quoted at $31@32.

Baltimore. April 12, 1876.

Specially reported by Messrs. R. C. HOFFMAN & Co.

The iron market still continues dull and depressed, with small sales at about quotations.

Baltimore Charcoal	$30@34	Anthracite No. 3	$20@21 00
Virginia Charcoal	28@33	Mottled and White	18@19 00
Anthracite No. 1	23@24	Charcoal C B. Blooms	65@67 50
" No. 2	21@22	Refined Blooms	55@60

Boston. April 13, 1876.

PIG has been somewhat staggered by the announcement of a week ago in the ENGINEERING AND MINING JOURNAL of popular brands of No. 1 selling in New York at $21 f. o. b. The small business quoted a week ago has consequently been lost, and the market closes dull. The lowest base price open in this market was through the canvass of the Ailentown and other brands for orders stringing through any of the coming six months at $23 No. 1 X f. o. b. and $1.50 freight. A cargo Port Orem

XX now delivering is credibly reported as having been bought at $19.75 f. o. b. All this would suggest that this market might yet job the best No. 1's at $25 and perhaps less, and No. 2's at $22. The bottom of the market must be somewhere, as the fact that the 26 filterers for the Standard Sugar Refinery, weighing 500 tons, to be good dry sand castings were contracted for at 2¼c. will attest. But the prices above named are not yet quoting low enough if this order is any index.

BAR sells along at $49, with no little gossip that $47 is the proper market value, but a very careful and very general inquiry fails to make it at all certain. Sales have been made at this value, but they include some peculiar conditions that emphasize the transactions as *very* exceptional. The Cleveland mills have offered to fill ordinary orders at 2c. with a 30c. freight, but have taken no business. They are not low enough. Boiler plates and rivets are selling fairly at 3c. for No. 1 charcoal plate, and 5¼@5¾c. for rivets. Cut Nails have settled to $2.90 without charge for keg or city delivery. The Fall River company have placed their Boston agency with BACON & BROWN. The Rhode Island horse shoes have been advanced to 5 8-10c. out of store.

STEEL is having a quiet trade, something doing in machinery, and a trivial inquiry for boiler.

We quote American tool 14@15c.; American Machinery 8½@9½c.; Bessemer tires 5¾c.; Sweet's Excelsior tire, 7½c.; English tool, 15½c., gold.—*Commercial Bulletin.*

Chattanooga, Tenn. April 10, 1876.

Specially reported by J. F. JAMES pig iron broker, etc., 233 Market Street.

The market remains dull and prices unchanged, with no prospect for immediate improvement. The foundries south and southwest claim that business is duller than at any time during the past four years.

The usual four months' time on quotations below is allowed.

Tenn. Ala. and Ga. Charcoal,	No. 1 foundry	$21@ 22
" " " "	No. 2 foundry	20@ 21
" " " "	gray forge	17@ 18
" and Georgia coke,	No. 1 foundry	18@ 19
" " " "	No 2 foundry	17@ 18
" " " "	gray forge	16@ 17
White and Mottled		14@ —
Tennessee and Georgia cold-blast car wheel		24@ 25
Alabama " "		24@ 25
Old Rails		cash 21 50
Cast Scrap		" 12
Wrought Scrap		" 22

Cincinnati. April 11, 1876.

Specially reported by Messrs. TRABER & AUBERY, commission merchants for the sale of pig iron, blooms, ore, etc.

Below will be found closing quotations of our pig iron market.

CHARCOAL.		
Hanging Rock, No. 1	Foundry	$25 00@ —4 mos
" No 2,	"	23 00@ —4 mos
" Mill		22 00@ —4 mos
Tennessee, No. 1,	Foundry	23 00@24 00—4 mos
Tennessee, No. 2,	"	22 00@23 00—4 mos
" Mill		21 00@22 00—4 mos
Missouri, No. 1,	Foundry	@ —4 mos
STONE COAL.		
Ohio, No. 1,	Foundry	22 00@23 00—4 mos
" No. 2,	"	21 00@22 00—4 mos
Ohio Mill		20 00@21 00—4 mos
Missouri, No. 1	Foundry	27 00@ —4 mos
" No. 2,	"	26 00@ —4 mos
" Mill		24 00@ —4 mos
CAR-WHEEL.		
Hanging Rock, C. B.		40 00@45 00—4 mos
Tennessee "		30 00@32 00—4 mos
Missouri "		32 00@35 00—4 mos
Alabama "		30 00@32 00—4 mos
BLOOMS.		
Charcoal		60 00@ 70 00—cash
SCRAP IRON.		
Cast		50c.@ 90—cash
Wrought		1 00@1 30—cash

Louisville. April 11, 1876.

Specially reported by Messrs. GEORGE H. HULL & Co.

Our market has shown a little more activity since last report, but without improvement in prices. On the contrary, inferior grades are offering freely at slight concessions. Holders of round lots evincing a disposition to realize rather than hold longer.

The usual time, four mos., is allowed on the quotations below:

HOT BLAST—CHARCOAL.		
No. 1 Foundry, from	Hanging Rock Ores	$25 00@26 00
No. 2 "	" "	23 00@24 00
No. 1, Mill, from	" "	—@ —
No. 1, Foundry, from	Alabama, Georgia and Tennessee ores	23 00@24 00
No. 2, Foundry, from	Ala., Geor'a and Tenn. ores	22 00@23 00
No. 1, Mill, from	" " " "	21 00@22 00
HOT BLAST—STONE COAL AND COKE.		
No. 1, Foundry, from	Hanging Rock Ores	23 00@24 00
No. 2, "	" "	22 00@23 00
No. 1, Mill,	" " " "	21 00@22 00
No. 1, Foundry, from	Ala. Ga. and Tenn. Ores.	23 00@24 00
No. 2, "	" " " "	22 00@23 00
No. 1, Mill,	" " " "	21 00@22 00
No. 1 Foundry, from	Missouri Ores	24 00@25 00
No. 2 "	" "	24 00@25 00
No. 1 Mill, from	Missouri Ores	25 00@26 00
COLD BLAST—CHARCOAL.		
Car Wheel from	Hanging Rock Ores	35 00@40 00
" "	Tennessee	28 00@30 00
" "	Alabama and Georgia Ores	28 00@38 00
" "	Kentucky Ores	28 00@40 00

Milwaukee. April 10, 1876.

In pig iron sales have been larger, but at less prices on Frankfort and Bay View.

		per ton of 2,240 lb.
Frankfort L. S. Charcoal,	No. 1	$28 00
" " "	No. 2	27 00
" " "	No. 3, 4 & 5	25 00
" " "	No. 6	25 00
Mil. Anthracite L. S.,	No. 1	27 00
" " "	No. 2	26 00
Wisconsin Iron,	No. 1	25 00
Mahoning Valley Bit's	No. 1	30 00
" " "	No. 2	28 00

Pittsburgh, Pa. April 12, 1876.

Specially reported by A. H. CHILDS, Esq.

The metal market has been quite active since last report, and sales larger than for many weeks past.

Prices, although nominally unchanged, are much firmer than heretofore, and some advance is not improbable.

No 1. foundry		$24 00@25 00—4 mos
" 2. "		22 50@24 00—4 mos
Gray forge		21 00@22 50—4 mos
White and mottled		18 00@20 00—4 mos
Warm blast charcoal		22 00@25 00—4 mos
Cold b last "	Western	40 00@45 00—4 mos

Richmond, Va. April 10, 1876.

Reported by ASA SNYDER, Esq.

Iron continues very quiet. No change in quotations.

San Francisco, Cal.

From the *Commercial Herald*, March 30, 1876.

The ship *Vancouver*, from Liverpool, brought 300 tons pig iron. The *Idaho*, from Portland, 60 tons Oregon pig iron. We note a sale of 100 tons Scotch Glengarnock pig iron, private. The stock here is large, and prices altogether nominal. The foundrymen are carrying heavy stocks and much that is to arrive, bought upon contract at low figures. Bar and other manufactured iron is both plentiful and cheap. Sydney tin we quote at 21@21½c.; tin plate is abundant, with light demand.

St. Louis. April 11, 1876.

Specially reported by Messrs. SPOONER & COLLINS, Commission Agents for all kinds of Iron.

Our market shows no change from last week. Prices still rule low.

Montreal. April 6, 1876.

We continue to quote: Pig iron Eglinton and Clyde $21.00@21.50; Carnbroe $21 50@22; American $24@26; Summerlie and Calder $22.00@23.00; Langloan and Gartsherrie $22.00@22.00; Coltness $22.50@23.50; Hematite $30.00@31.00. Bar, per 100 lb., Scotch and Stafford shire, $2.20@2.25; best do., $2.50@2.60. Swedes and Norway $5.00@5.50; Lowmoor and Bowling, $6.50@7.00.—*Monetary Times.*

Prices Paid for Silver Ores at Western Reduction Works.

GEORGETOWN, COLORADO, April 4, 1876.

Lead and copper remain as quoted in my last.

D. W. B.

Yield of ore in silver.	Price per oz. silver, on basis of 25 per cent. lead.*	Yield of ore in silver.	Price per oz. silver, on basis of 25 per cent. lead.
oz.	cents.	oz.	cents.
50	26	200	84
60	38	250	87
70	46	300	90
80	53	350	92
90	58	400	94
100	63	450	96
110	67	500	98
120	70	600	99
130	73	700	100
140	75	800	101
150	77	900	102
175	80	1000	103

* $1.00 paid for each per cent. over 25 per cent. lead.
* $1.50 paid for each per cent. of copper.
* Mill charges $4.00 per ton. Small lots $2.00

SALT LAKE CITY.—Ferruginous lead ores, $1.15 per oz. Ag., on a basis of 25 to 30 per cent. Pb. according to amount of silver in ore, under 30 oz., the basis would be 30 per cent. Pb. Siliceous ores. $1.00 to $1.05, oz. Ag., on a basis of 35 to 50 per cent. Pb. This varies according to the amount of sulphur in the ore, and whether roasting is required. 2 per cent. of silica to be taken up by iron.

METALS.

NEW YORK, FRIDAY EVENING, April 14, 1876.

Business in this city has been very dull. To-day is almost a holiday, while in London there is nothing doing. Prices have shown no particular change, although there is generally an inclination to weakness. There are no indications of an early improvement. Purchases are only being made for immediate necessities.

MR. ERNEST W. S. MURRANT, of London, under date of March 30, says: "Little or no alteration in prices has taken place during the week, the continued steadiness of the metal market during the present dull period contrasting very favorably with the violent fluctuations of other markets."

Gold Coin.—During the week under review, gold has ranged from 112⅝ to 113½ and closed at 113¼.

Bullion.—The passage of the Silver Bill in Congress, and the announcement that a $20,000,000 loan will be placed upon the London market by the Indian Government, enabling that market to dispose of some of its silver, has caused prices to advance. The London market closed at 54d., yesterday, an advance of ¼d. since our last. Quotations here to-day range from $1.17½@$1.18¼ an advance of about 1½c. San Francisco quoted at 10 per cent. discount, an improvement of 2 per cent. Fine gold bars are unchanged, and quoted as follows: this market par ($20.67 gold, per oz.) to ¼ per cent. premium. San Francisco, par; and London, 84/7½d.

Copper.—We are reported sales aggregating about 250,000 lb. at 22⅝c.@22¾c. Lake is quoted to-day at 22¾c.@23c., and Baltimore at 22½c. There is but very little outside copper offering, while at the same time the wants of consumers are very light.

MR. MURRANT says of copper: "Chili is exactly the price which was quoted this time last week, and is wonderfully steady considering all the circumstances; this simply shows the perfect soundness of this trade. The public sale of Australian went off at a reasonable figure, and in a manner which cannot have failed to give the utmost satisfaction to all concerned. The next sale takes place on 27th June, when about the same quantity (2,000 tons) will be offered, practically without reserve."

Tin.—This metal is very quiet. We quote Straits in large lots at 16½c., with a little business done at a less figure. In small lots it is quoted at 16¾c.@17c., gold. The London quotation, yesterday, was £72 10/, and at Singapore $21¼ per picul. L. and F. is neglected at 16¼c.@16⅝c., gold. Refined is quoted at 17½c,, and Banca at 22c., gold.

MR. MURRANT says of tin: "Foreign maintains its price at present, the deliveries from London stock for this month being good, the arrivals moderate and shipments from the Straits and Australia comparatively small, and if these favorable conditions continued for a few months no doubt higher rates would be the result. It is easy for holders to say "this is what you are continually telling us, and yet prices keep falling," but the continued drop is the inevitable result of a supply of the article, which has been for some time, and is still, greatly in excess of the demand. The little business done during the week has ranged from 72/ 6d. to 74/ for Straits and Australian for spot and forward lots."

Tin Plates.—There is only a very limited business doing in these. Quotations in gold, per box as follows: Charcoal tins, $7.12½@$7.37½, and ternes $6.75@$7; coke tins, $6.25@$6.37½, and terns, $6@$6.12½.

MESSRS. SANDERS BROTHERS, of London, under date March 31, say of tin plates: "During the past month the tin plate market seems to have gone from bad to worse, and for the sake of makers and holders of stocks generally, we trust we have got to the worst. Until a few days ago there has not, practically, been any new business done, and makers in their endeavours to get orders have quoted lower and lower prices. This reduction, coming little by little, has been productive of very little good to themselves. We are not only suffering now from great depression in trade generally, but tin plates have been in an additionally unfavorable position on account of consumption not being equal to production. At the lowest prices that have been reached during the last month, there is no doubt a loss on making plates. Makers seem to have become thoroughly alive to the desperate condition the trade had drifted into through over production, and at a meeting, held on Thursday 16th inst., of the principal South Wales manufacturers, it was resolved to curtail production by working only two weeks out of every three. At first 110 mills, which represent between two-fifths and one-third of the whole, agreed to this, but we hear, day after day, of fresh accessions to the list. It is not at all improbable that eventually the bulk of the works in the country will agree to it, and in this way the make of plates will be practically reduced one-third. That it will be honestly carried out we have every reason to believe, as a penalty of £500 is attached to any infringement. This altered position of affairs will place the trade generally in a very much healthier state as far as makers are concerned. We already notice a stiffening in prices in many quarters, in others an indisposition to quote at all at present. As we write there is an increased disposition to buy plates, though it is not by any means so general as we have seen it before. This reduction remains in force for three months only, but if it be productive of general good to manufacturers it is quite probable that it will be continued further. Some makers of coke plates who a few weeks ago, would have sold at 19/6 Liverpool, now quote 21/, as their lowest price for the oil grades of coke tin. We were offered good charcoal tin a short time since at 24/, to-day 25/, is the lowest figure.

"The low price of tin, to which we refer elsewhere, helps makers of tin plates a little. The downward tendency of Iron and Coal is also in their favor. Of course it remains yet to be seen whether the operatives at the tin plate works will submit to an enforced idleness during one-third of their time. According to our latest returns, the stock of tin plates in Liverpool is a little over 300,000 boxes, showing a considerable increase over the past month."

Lead.—The Government not finding buyers for its lead at 6·35c. gold, has had a tendency to make prices weaker. The business done during the week has been of a very limited nature at 6·35@6·37½c, gold. Foreign and Missouri leads are without change.

Spelter.—Domestic spelter is said to be very steady at 8c currency. Outside lots of this article are reported to have been pretty well sold out. There is but very little business doing. 25 tons of foreign W. H. are reported to have been sold at 7·30c gold. Sheet zinc is quiet at 8⅝@8¾c gold.

Antimony.—Is quiet but very firm at 16c. gold.

Quicksilver.—Is quoted at 63c.@64c in this city; 59c@60c. in San Francisco; and £10 in London.

The San Francisco *Commercial Herald*, of March 30, says: The receipts from the mines are steadily increasing. The *Vasco de Gama*, for Hongkong, is under engagement to carry some thousand flasks or more, at a low rate of freight—say 20c. per flask. The market is quite firm at 58@59c. for export parcels.

FINANCIAL.

New York Stocks.

FRIDAY, April 14, 1876.

The New York Stock Market has been extremely dull during the week under review, and a general fall in prices has occurred. This decline is especially notable in the coal carrying stocks—ranging from ⅛ to $3 per share.

New Jersey Central Railroad.—We note sales of this stock aggregating 6,318 shares, between 99 and 103 as the extreme limits, the bulk of the transactions, however, have been made at from 101 to 102½. The closing quotation shows a decline of about 2¼ below the rate ruling a week ago.

Delaware, Lackawanna and Western RR. exhibits a decline equal to that of the New Jersey Central Railroad, with sales amounting to 3,447 shares.

Delaware and Hudson Canal Company's stock has changed hands to the unusual amount of nearly 1,000 shares, the closing quotation representing a decline of nearly $3 per share. The annual meeting of this company will be held on the 9th of May.

Consolidation Coal.—This stock shows a decline of ⅛, with sales of 850 shares for the week. In our coal trade review we speak of the policy which is said to have maintained the rates of this stock.

Mariposa Land and Mining Company has been neglected. We note sales of $15,000 of the 7 per cent. convertible gold bonds of this company during the week at from 102⅛ to 102¾. Recent information from the mine states that the crossent (No. 3) in the tunnel was 407 feet long. It had passed through 76 feet of vein matter, and had not yet reached the east wall. The ore is of low grade, yielding from $2.50 to $4 per ton.

Union Mining Company of Tennessee.—1662 shares of this stock was sold during the week at from 1½ to 1⅞.

Chesapeake and Ohio RR.—The tellers appointed to receive and canvass the ballots for the election of the Committee of Purchase and Reorganization of this road report the result as follows:

Amount 1st mort. 6 per cent. bonds voted $8,904 900
7 per cent. bonds voted 10,438 000

The following gentlemen are elected as the committee: A. A. Low, John Castree, C. P. Huntington, A. S. Hatch and Isaac Davenport, Jr. The result shows great interest and unanimity on the part of the bondholders in the plan of reorganization, and assures its successful accomplishment. The above committee will proceed to purchase the road, and by the laws of Virginia become the new company, and can then reorganize the corporation.

Baltimore and Ohio RR.—The directors of this company, at their meeting in Baltimore on the 12th inst., declared a dividend of five per cent. on the stock of the main stem for the year ended March 31, payable on and after May 1. The transfer books will be closed the 19th inst. It was voted inexpedient to declare a dividend on the stock of the Washington branch, in view of the continued claim of the State of Maryland for the 20 per cent. tax. Appeals were taken from the recent decisions against the company on this question. The directors also resolved to give up the Valley road from Harrisburg to Staunton rather than retain it on the term demanded by the Valley Railroad Company.

Quotations and Sales of Stocks and Bonds,

For the week ending April 14, 1876.

STOCKS.

	Highest	Lowest	Closing	Shares sold.
Pennsylvania Coal Co	—	—	265	—
Consolidation Coal Co	44⅞	42½	42½	850
Spring Mt. Coal Co	—	—	*64¾	—
American Coal Co	—	—	50	—
Maryland Coal Co.	—	—	15	100
Del., Lack., and West. RR. Co.	117½	114¼	114¼	3447
New Jersey Central RR. Co.	103	99	99½	6318
Delaware and Hudson Canal Co.	118½	114½	115½	964
Quicksilver Mining Co. pref'd	22¾	23	22¾	300
" " " Common	18	17	17	600
Mariposa Land & Min. Co. various.	—	—	—	—
St. Louis & Iron Mountain RR.	22	20½	20½	250
Lehigh & Wilkes-Barre Coal Co.	—	—	*40	—
Total Shares sold				12829
Sales for the week previous				12138
Increase				691

* These are nominal quotations.

BONDS.

	Sales.		Price
Ches. & O. R. R. 6s, 1st. coupon	—		— @ —
" " " ex coupon	—		— @ —
Central RR. of N. J. 1st Mtg. N.	5,000		— @113½
" " " 1st Cons.	—		— @ —
" " " Convt.	77,000		107⅛@109
Del. and H. Canal, 1st Mtg. 91'	2,000		— @111
" " 78, '84	2,000		— @109¼
" " Reg. '77	7,000		— @105
Del., Lack. & W. R. R., 7s, conv.	—		— @ —
" " " " 2d Mtg.	—		— @ —
St. Louis & Iron Mount'n 1st Mtg	7,000		100 @101
St. Louis & Iron M'tn 2d Mtg.	—		— @ —
Lehigh & Wilkes-Barre Cons.	14,000		94¾@ 95¼
Total Sales	$114,000		

Closing quotations, in the absence of sales, represent the latest prices bid.

Philadelphia Stocks.

PHILADELPHIA, April 14, 1876.

Without exception, the Philadelphia stock market is lower, and a dull, uncertain feeling has characterized the operations of the week; the total transactions aggregate some 83,000 shares, the principal dealings being in the stock of the Reading Railroad Company, the sales in which have amounted to 45,700 shares, closing at 46½, being a decline of $1 per share.

Pennsylvania Railroad.—This stock is a fraction lower, sales for the week amounting to some 32,000 shares.

Lehigh Coal and Navigation Canal Co.—We note a decline of nearly $1 per share in the stock of this company, with sales of 4,320 shares for the week.

Lehigh Valley RR. Co.—This stock represents transactions of about 1,000 shares, closing at a decline of nearly $1 per share from our last quotations. We note that this company is making arrangements to establish a large coal depot in Newark, N. J. The depot and yard is to be located in the outskirts of the city, where property has been bought, and the company has applied to the City Council for leave to occupy portions of one or two streets to make the necessary connections with the yard. This will probably be granted, as the streets in question are not built up, and are very little used. Coal coming to this depot will be hauled over the Pennsylvania tracks from Metuchen, where the New Jersey Division of the Lehigh Valley crosses that road.

Cambria Iron Co.—200 shares of this stock sold at auction during the week at from $16¼ to 16⅛ per share.

Morris Canal Co. 100 shares were sold on the Board at $55 per share.

Catawissa R. R. Co.—The annual meeting of the stockholders of this Company was held on the 4th inst. The receipts of the year under the terms of the lease have been $202,000, out of which a dividend of seven per cent. has been paid on the preferred stock and four and two-thirds per cent. on the second preferred, according to the terms of the lease. The amount paid by the lessees for the year ending November 1st, 1876, will probably enable the company to increase the dividend on this stock to seven per cent. In common with all other roads and in sympathy with the depressed condition of the business interests, the lessees report a falling off in the receipts, the gross receipts for 1875 being $640,905.31.

The Allegheny Valley Railroad Company at their recent annual meeting at Pittsburgh, submitted the following statement of the business of the company for 1875; it shows an increase in the net earnings over those of 1874 of $65,954. Total earnings, $2,399 638; expenses, $1,414,996; net earnings, $984,642.

The Pennsylvania Steel Company announces a dividend of three per cent. payable April 15.

Bonds have been dealt in to the extent of $114,900, with quotations barely maintained.

Quotations and Sales of Stocks and Bonds,

For the week ending April 13, 1876.

STOCKS.

	Highest	Lowest	Closing	Shr's
Lehigh Valley RR. Co.	61⅞	61	61	1023
Pennsylvania RR.	57¼	56¼	56⅝	32100
Reading RR.	48¼	46	46½	45700
Lehigh Coal and Nav. Co	50	49½	49½	4320
Penn. Canal	—	—	*9	—
Buck Mountain Coal Co.	—	—	*30	—
Fulton Coal Co.	—	—	*3½	—
Locust Mountain Coal Co	—	—	—	—
Westmoreland Coal Co.	—	—	*84	—
St. Nicholas Coal Co.	—	—	*1	—
Cambria Iron Co.	—	—	16½	—
Crane Iron Co.	—	—	*46	—
Emaus Iron Co	—	—	—	—
Pennsylvania Salt Manufact. Co.	—	—	68	76
Total shares sold				83,219
Sales for the week previous				110,056
Decrease				26,837

* These quotations are nominal.

BONDS.

	Sales.	Price
H. and B. T. RR. 1st mortgage, 78	1,000	— @110
" " " 2d " "	—	— @104
" " " 3d " cons	—	— @ 59†
Lehigh Valley RR. Con. mtg. 6s, Reg	11,000	— @101
" " 7s, 1910	1,000	— @106½
" " 6s Reg. and Cou	3,000	106 @107½
Pennsylvania RR., 1st mtge. 6s	5,000	— @105
" gen. " cou. 1910	—	— @105
" " gen. " 6s, reg.	7,000	— @105¼
" " Cons. M. 6s reg.	—	— @103
Phil. & Reading RR. 7s '93	—	— @108
" " G. M. 7s, reg.	—	— @108⅛
" " " " Deb. 6s	3,000	— @ 82½
" " new convertible 7s.	33,600	103 @104
Phil. & Reading C. & I. Co. Deb. 7s	13,000	81¼@ 81¾
" " Swatara tract.	2 000	— @ 87
Lehigh Coal & Nav. Co., 6s '84	4,700	102¾@103
" " " RR. 6s, '97	4,100	103 @103½
" " " gen m. 7s Reg.	—	— @105
" " " Convt. gold, '97	16,500	— @104½
Penn. Canal, 6s	—	— @ 76
Penn. and N. Y. Canal, 7s	10,000	— @109¾
Ches. and Del. Canal, 6s	—	— @ 86½
Susquehanna Canal, 6s	—	— @ 77
Delaware Division Canal, 6s	—	— @ 99¾
Susquehanna Coal Co. 7s	—	— @ 85
Buck. Mount Coal Co. 6s	—	— @ 97½
Penn. Gas Coal Co. 6s	—	— @100¼
Total amount of sales	$114,900	

Closing quotations, in the absence of sales, represent the latest prices bid.

† Asked.

Gold and Silver Stocks.

NEW YORK, April 14, 1876.

The San Francisco Share Market is irregular, with quotations inclining upwards.

Consolidated Virginia shows a decline of $5 per share. The bullion product of this mine, for the month of March, will amount to nearly $3,500,000. The ore breasts, at present, are yielding enormous quantities of very rich ore, the weekly product amounting to between 5,000 and 6,000 tons. The expenses of this company for March were about $300,000; dividend, $1,080,000, leaving a balance to be carried to the surplus fund of over $2,000,000. It was expected by some, in consequence of the increased yield of bullion by the mine, that the monthly dividend would also be increased, and the refusal of the managers to do this has created some dissatisfaction among the stockholders. They anticipated a dividend of at least $3 per share, which would be equal to $15 per share on the old issue, and still leave $1,500,000 as surplus from the March earnings.

California exhibits an advance of $2 per share, and is firmly held at our quotation. The lower levels of this mine are being put in excellent repair. Winze No. 6 is now 104 feet below the 1,500 level, showing high-grade ore. The C. & C. shaft has attained a depth of 1,179 feet at last advices. The water is decreasing.

We glean the following items from our correspondents and exchanges:

MINING NOTES.

The Kossuth Mining Company, owning a claim on the Comstock Lode, proposes to sell about one-half of its property to a new corporation with a capital of $10,800,000.

The Raymond & Ely mine is yielding about 75 tons of ore daily.

Reports from Colorado state that the silver vein found in the Douglas Tunnel some months since now yields more gold than silver, and it is possibly changing into a gold lode.

The Eureka Gold Mine produced 350 ounces amalgam the last week's run. The main vein is now 12 inches thick, solid quartz.

Ophir is in free request at advanced figures. Daily yield of ore, 150 tons. The bullion product of the current month will pay all the expenses of the mine.

Belcher extracts 465 tons per day. The ore developments below the 1,500 level are said to be very promising.

The Silver Cloud Mine located on Sherman Mountain, Clear Creek County, Colorado, received from a recent mill run of two tons, returns of 342 ounces of silver of the first class, and 196 ounces of silver for the second class, to the ton of ore.

The quicksilver shipments from San Francisco to various ports during March were:

	Flasks.	Valve.
China	2,410	$108,810
New York	600	27,919
Mexico	327	15 245
South America	360	16 233
Central America	30	1,325
Japan	29	1,411
Total	3,756	$170,943

The Franklin Mill, on the Carson River, has been started up on ores from the Belcher Mine.

The Sutro Tunnel is advancing at the remarkable rate of over 100 feet a week. Its present length 12 775 feet, heading 8x10 feet. Temperature at the face 85°. Quantity of water, 48 miners inches.

Incorporations.—The Sacramento *Record-Union* says that certificates of incorporation were filed in the office of the Secretary of State on Friday, March 24th, as follows:

Ely Gold and Silver Mining Co.; to mine in White Pine, Nevada, on the Benham lode. Capital stock, $5,000,000, in 50,000 shares of $100 each. Place of business San Francisco.

Eldorado Gold and Silver Mining Company of White Pine, Nevada. Capital stock, $3,000,000, in 30,000 shares of $100 each. Place of business San Francisco.

The *Juno Gold and Silver Mining Company* has been incorporated to mine in Nevada. Capital, $10,000,000.

Assessments, with dates when delinquent. Baltimore Con., $1, May 1st; Great Valley Blue Gravel, 25 cents, May 3d; Belmont, 50 cents, May 4th; Leopard, $1, May 3d; Savage, $2, May 8th; the Eureka Consolidated and Empire Mills and Mining Companies, $1; the Baltimore Consolidated Mining Company, $1, May 1st; the New York Mining Company, 50 cents, May 1st; the Kennedy Mining Company of Amador county, California, $1, May 2d; the Lady Bryan Mining Company, $1, April 27th.

The delinquent assessment list of the Sierra Nevada mine is published. The assessment was for $100 000, of which about $90,000 have already been paid. The sale will take place on the 18th proximo.

A stock dividend of two shares for one has been declared by the Alta Mining Company. These are the easiest kinds of dividends to pay.

QUOTATIONS:

	No. of feet on Vein.	No. of shares.	April 6.	April 13.
Sierra Nevada	3,300	100,000	$24	$25
Union Consol'd	600	100,000	18	17
Mexican	600	108,000	39	38
Ophir	675	108,000	69	67
California	600	540,000	86	88
Consol'd. Virginia	710	540,000	85	80
Best & Belcher	540	100,800	59	58
Gould & Curry	612	108,000	21	21
Savage	771	112,000	18	19
Hale & Norcross	400	16,000	70	70
Chollar Potosi	1,400	28,000	126	147
Alpha Consol'd	306	30,000	63	63
Imperial	184	100,000	17	18
Yellow Jacket	57	120,000	36	35
Kentuck	95	30,000	17	17
Crown Point	541	100,000	24	23
Belcher	1,040	104,000	35	—
Overman	1,200	38,400	81	82
Caledonia	2,188	100,000	12	13
Justice	2,100	105,000	30	31
Raymond & Ely	5,000	30,000	17	17
Meadow Valley	4,400	60,000	2	2
Eureka Consolid.	....	50,000	13	13
Eureka G. V.	1,680	20,000	3	3
Silver Hill	5,400	54,000	9	10
Julia	3,000	110,000	17	15

Copper Stocks.

Specially reported by Messrs. WILSON W. FAY & Co., Bankers and Brokers, Room 7 Traveller Building, 31 State Street, Boston.

BOSTON, WEDNESDAY EVENING, April 12, 1876.

The copper market remains as previously reported, and little can be said in regard to it. Allouez dull, not a sale for the whole week. Calumet sold down April 8, to 168¾, and is now 170½ bid. Central, one sale this week at 30½. Copper Falls has weakened materially,

selling down to 2. A special meeting of this company is to be held April 29, when it is probable that the capital stock will be increased. Pewabic, 4.50 bid, the adjourned meeting of this company will be held April 22. Quincy dull, but very firm at 404 bid, with sales at 40½. Madison is strong at .25, the other small coppers are neglected.

Sales for the week have been as follows: 62 shares of Calumet & Hecla, at from 168¾ to 170½; 85 shares of Quincy, at 42½; 100 shares of Central, at 30½; and 10 shares of Ridge, at $5 per share.

Calumet and Hecla.—The March product of this mine amounted to about 1,248 tons.

Oscoola.—About 95 tons represents the copper product of this company for he month of March.

Grand Rapids Mining Company.—We note the recent organization, in Ishpeming, Michigan, of a company with the above corporate title, for the purpose of mining silver and copper in the State of Michigan, on the South East Quarter, Sec. 12, Town 50, Range 43 West.

DESCRIPTION.	Par Value.	No. of Shares.	CLOSING. Bid.	Asked.
Allouez	$50	20,000	$19 00	$20 00
Calumet and Hecla	25	80,000	170 50	171 00
Central	25	20,000	30 00	30 50
Copper Falls	25	20,000	2 00	2 25
Dana	25	20,000	10	12½
Franklin	25	20,000	13 50	13 75
Humboldt	25	20,000	11	12½
Madisca	25	20,000	25	30
Mesnard	25	20,000	55	62½
Minnesota	25	20,000	1 75	2 25
National	15	20,000	2 25	2 50
Osceola	25	40,000	18 00	20 00
Petherick	25	20,000	50	60
Pewabic	25	20,000	4 50	5 00
Phenix	25	20,000	12 00	13 00
Quincy	25	20,000	40 25	40 50
Ridge	25	20,000	5 00	5 25
Rockland	25	20,000	25	30
International Silver	20	60,000	15	18
Star	25	20,000	5	7
Superior	25	20,000	10	15
Duncan Silver	20	60,000	1 40	1 50

Gas Stocks.

NEW YORK, April 14, 1876.

The market for gas stocks does not improve in the least, the disposition to sell being very prominent, while the inclination to purchase is as conspicuous by its absence. We alter but few of our quotations and those notably the New York, and Manhattan Companies, the former $4 and the latter about $5 per share below the prices ruling in our last.

Auction Sales of Stocks and Bonds.—The following were sold at auction during the week at the prices annexed.

Citizens Gas Co., of Rochester, N. Y, $9,000 of their 7 per cent. Coupon bonds at 81¼.

Mutual Gas Co., of New York, 100 shares at 108.

Metropolitan Gas Co., of New York, $640 of their scrip stock at 102¾.

Miscellaneous Sales.—From our correspondents and exchanges we collect the following recent transactions.

Salem, Mass., Gas Co., 18 shares at 100.

Lawrence, Mass, Gas Co., 5 shares at 126¼.

East Boston Gas Co., 26 shares at 31½.

Boston Gas Co., one share, 795.

Montreal Gas Co., 1957 shares at from 165¾ to 167¼.

People's Gas Co., Baltimore, Md., 100 shares at from 25⅝ to 25¾.

San Francisco Gas Co., 225 shares at from 99 to 99½ we note a recent purchase by this Company of 10.000 tons of Australian Gas Coal at $9.50 per ton.

Montreal City Gas Company.—The new gas company of this city, at its annual meeting held on the 3d inst., decided to increase the capital stock by two hundred thousand dollars. It is to be allotted among the present shareholders.

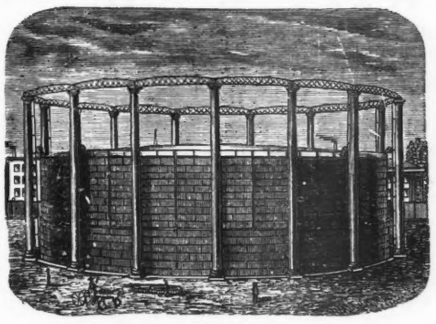
Hoboken, N J., Gas Company.—In our issue of the 1st inst., we noted the fact that a large number of prominent storekeepers in Hoboken had petitioned the gas company for a reduction in the price of gas. We learn that the gas company has informed this Central Citizens' Association that the company cannot sell gas for less than $3 a thousand. It is probable that all of the petitioners will substitute oil for gas, which would reduce the income of the company about $15,000 per year.

The following list of Companies in New York and vicinity are corrected weekly by GEORGE H. PRENTISS, Broker and Dealer in Gas Stocks, No. 30 Broad st., N. Y.

Quotations "bid" and "asked" of New York City and Vicinity Gas Companies are on the $100 of stock and not on one share.

Companies in New York and Vicinity.	Cap. Stk.	Par.	last Divid.	When Paid.	Bid.	Askd.
			pr.c			
Mutual, N. Y.	$5,000,000	$ 100	2¾	Jan. '76	108	108½
" " Bonds	900,00	1,000	‡3½	Feb. '76	105	
NewYork, "	4,000,000		5	Jan. '76	136	140
Metropol. "	2,500,000	100	5	Mar. '76	145	150
" " Certf.	1,000,000	...	3½	" "	102	103½
" " Bonds	500,000	1,000	3½	Jan. "	105	
Harlem "	1.850,000	50	4	Feb. '76	115	120
Manhattan"	4,000,000	50	10	Jan. "	250	255
Brooklyn, B'klyn	2,000,000	25	5	Nov. '75	190	195
Nassau "	1,000,000	20	4	Jan. '76	90	95
" " Certf.	700.000	1,000	3½	Nov. "	95	98
People's "	1,000,000	10	3½	Jan. '76	60	70
" " Certf.	300,000	1,000	3½	Jan. '76	85	86
" " Bds	325,000	....	3½	Feb. "		95
Metropol. "	1,000,000	10	3½	Nov. '75	70	75
Wmsburgh "	1,000,000	50	5	Jan. '76	120	125
" " Certf.	1,000,000	....	3½	Jan. "	98	100
Citizen's "	1,200,000	20	2½	Jan. '76	95	100
" " Certf.	320,000	1,000	3½	April "	99	101
J. C. N.J.	386,000	20	5	July,'75	160	170
Centl. Westch. N.Y.	466,000	50	4	July. "	95	100

‡ Gold.



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Companies out of Town.*	Cap. Stk.	Par	Bid	Askd.
People's " " of J. C.			125	135
¶Citizen's G. L. Co., New'k. N.J.	1,095,000	50	85	90
Hempstead" " L. I., N.Y.	40,000	100		100
Jamaica, " " "	25,000	100		100
Richmond Co., S. I. "	300,000		100	105
Citizens', Rochester, "		100	60	68
Rochester Gas Co., "		100	50	
‖People's G. L. Co. Albany,"	1,000,000	100		40
§Mutual " Buffalo "	750,000	100	45	55
Mutual " Detroit Mich.		50	18	
TroyG. L. Co., Troy, N. Y.			108	
Brockport, N. Y., G. L. Co.	25,000	100	60	80
†Baltimore G. L. Co., Balt., Md	2,000,000	100	178	179
St. Louis G. L. Co., St.Louis, Mo	600,000		110	130
People's G. L. Co., Balt., Md	2,000,000	25	25⅝	25¾
Hannibal G. L. Co., Hanni., Mo.	100,000	100	95	100
La Clede, St. Louis, Mo	1,200,000	100	110	115
Lewiston G. L. Co., Lewis., Me	400,000	100	33	
Chicago G. L. Co., Chicago, Ill.	2,000,000	100	140	
Jacksonville, Ill.	120,000	100	82	
‡Lima, Ohio	60.000	100	10	
Derby G. L. Co., Derby, Conn.	160,000	100	60	80
Woonskt G. L. Co. Woonskt, R.I.	150,000	100	100	
Fort Wayne G. L. Co. F. W., Ind		100	90	100
North. LibertiesG. L. Co. Phila.		25	29	
Wilkes-Barre G. L. Co. W. B. Pa.		50	70	
Washington G. L. Co., Phila.			42	43
Pottsville, Pa., Gas Co		50	40¼	
Portland G. L. Co. Portland, Me	350,000	50	72	75
Hartford G. L. Co., Hartford, Ct	700,000	25	41	
Boston G. L. Co., Boston, Mass.	2,500,000	500	785	790
East Boston, Mass		25	132	
Chelsea G. L. Co. Chelsea, "	300,000		139	
Cambridge G. L. Co., Cam., "	700,000		132¾	
Louisville G. L. Co., Louis., Ky.			127	
Cincinnati G. L. Co, Cincin, O.				200
St. Louis G. L. Co		50		160
Carondelet G. L. Co., Mo		50		64
S. F. G. L. Co. San Francisco, Cal	10,000,000	100	99¼	99¾
City G. L. Co. Montreal, Can.	1,440,000	40	165¾	167¼
Consumers G. L (old.) Tor., Ont	600,000	50	131½	
Hamilton G. L. Co., Ont.	150,000	40	112½	
Halifax G. L. Co., Halifax, N.S.	400,000	40	146½	

* These quotations represent the latest obtainable prices at which sales were made.

† This Company has issued $1.000,000 in certificates in addition to their stock indebtedness, on which they pay interest at the rate of 6 per cent. gold.

‡ This Company has $30,000 in bonds outstanding.

§ $200,000 represents the bonded indebtedness of this Company; these bonds are quoted at from 80 to 85.

‖ $350,000 of the indebtedness of this company is represented by bonds.

¶ $124,000 of the indebtedness of this company is represented by bonds; also $53,000 in certificates, which is included in the aggregate stock debt quoted.

AMERICAN INSTITUTE OF MINING ENGINEERS.

The third volume of Transactions of the Institute has been mailed to all members and associates elected prior to the February meeting. Prompt notification is requested in cases where the volume has not been received.

Foreign members of the Institute may obtain the volume by remittance of five dollars to the Secretary.

Copies of Volumes I. and II. may be had of the Secretary for five dollars each.

THOMAS M. DROWN, Secretary,
Lafayette College, Easton, Pa.

MARCH 8th, 1876.

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Its subscribers comprise nearly all the proprietors, managers, and agents of collieries and ironworks in the United Kingdom, and include also a very large proportion of the upper class of officials entrusted with the management of the various departments of coal mining and iron making. It also circulates largely amongst gentlemen engaged in scientific pursuits, and in the various branches of manufacture and commerce.

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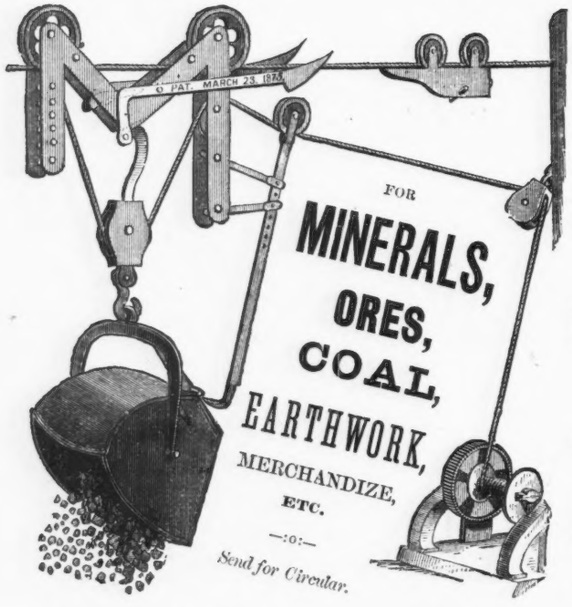

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